The Pageant of Nature

British Wild Life & Its Wonders

EDITED BY

P. Chalmers Mitchell

D.Sc., LL.D., F.R.S., C.B.E.

THE PAGEANT OF NATURE

THE IRREPRESSIBLE FRONDS OF THE BRACKEN.

From a Colour Transparency by Reginald Malby, F.R.H.S.

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P. CHALMERS MITCHELL, C.B.E., D.Sc.
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The Family of the Ferns

Photo: S. Leonard Bastin.

With the coming of the spring the new leaves of the Bracken start to push their way up. They are of a pale green, and are often tipped with a pretty brown gold shade.

1.—THE AGGRESSIVE BRACKEN

By S. LEONARD BASTIN

IN the struggle for existence on this earth, some plants appear to be much better equipped than others. From this standpoint there are few more remarkable cases than that of the common bracken fern. The species is not only by far the most frequent of the native ferns, but it is also one of the most widespread of our wild plants. The bracken seems to be at home under almost any conditions. It not uncommonly grows quite close to the seashore, and, in a stunted form, it can hold its own near to the summits of our highest mountains. On the open heath the bracken is able to keep up a dominant position, whilst in the deep shade of the woods it is equally happy. There is little doubt that if all the land in the British Isles were to go out of cultivation, the bracken would rapidly take complete possession of the neglected areas.

In many parts of the country the bracken is exceedingly troublesome to the farmer. The fern, if left alone, will soon destroy a good pasture, and it does not always prove an easy matter to get rid of the pest. Practically the only plan which has been found to meet the case is the continual cutting of the leaves just as they reach development. The endeavour to replace the lost fronds has a very weakening effect on the plant, and after a while it dies out. The process may take as long as three or four years, however, before it is completely successful.

But while bracken is obviously a pest in meadow or cultivated land, it has its uses even for the farmer. On hill farms, and grass holdings where little corn is grown, it is invariably harvested and stacked for the winter bedding of stock, and if cut green it has a certain manurial value when spread afterwards on the land, though it is not so rich as manure made from good straw.

The creeping underground stems of the plant contain an abundant supply of starch which can be used as food both for men and animals, and has actually been resorted to in times of scarcity. Its use was advocated during the late war when there was a shortage of bread, but the English are apt to be too conservative to take advantage of such a suggestion. In the Canaries, however, the main food of the natives—gofio—is made from these stems ground into meal and mixed with various kinds of ground corn. It is a peculiar food of a pleasant, nutty flavour, but exceedingly difficult to eat—as the inhabitants eat it—in its dry state. It must possess nutritive qualities, however, since many people live on it as a substitute for bread, if not, indeed, for meat.

As is the case with many other delightful weeds, farmer and artist are ever at cross-purposes with regard to bracken. While the former wages incessant war against the spread of these irrepressible fronds, yet the artist can find nothing but pleasure in the sight of a waving sea of bracken flooding the slopes and undulations of some old pine wood. However much man may scar and desecrate the wilds by cutting, burning, or dumping his pots and pans, yet each year comes up that luxuriant spring-green mantle that covers his traces and makes earth sweet and clean once more.

Photo: S. Leonard Bastin.

The reason why Bracken is so well equipped for its needs of growth may be found in the fact that its underground stems possess a considerable reserve of buds.

It is interesting to consider some of the reasons why the bracken is so well able to hold its own against all comers. In the first place, the plant is a very strong-growing perennial. The fronds arise from the stout creeping stem or *rhizome* which is below the surface of the soil. From the underside of the rhizome quantities of fibrous roots are sent out. When a portion of the root-stock of bracken is examined it is seen that the stalks arise from each side of the stem. In every season one or, now and again, two fronds are sent up, and traces of the leaf-stalks of past years are to be plainly seen. Beyond the present year's leaf there are the buds for next season's frond, and, at times, these are developed for three seasons ahead. So that if an accident happen to any particular leaf there is usually another ready to take its place.

The rootstock of the bracken is a most complicated affair, seeing that new branches are continually being sent out from the bases of the leaf-stalk. One supposes that, sooner or later, an individual bracken plant must die; but the vegetative vigour of this fern is so great that there seems no reason why it should not go on almost indefinitely. True, the rhizome is always decaying at one

Photo: A. Harold Bastin.

In the shade of the woods Bracken will grow much more luxuriantly than it does on the open heath.

Photo: S. Leonard Bastin.

Although regarded as a pest by the farmer, the sight of a waving sea of Bracken will ever move the artist to pleasure.

BRACKEN AND ELDER

The Bracken seems to be at home under almost any

Photo: Eleanor Shiffner.

N THE SOUTH DOWNS.

nditions, but it flourishes best on light, dry soil.

end, but at the other extreme, growth goes forward very actively.

The fact that the bracken is, apart from its leaves, an underground plant is enormously in its favour. In the rhizomes there is always a liberal store of food material which, as occasion demands, is ready for forming new leaves when the growing time comes. It is this which has made it possible for the bracken to establish itself almost throughout the world. The fern has been observed in such widely separated places as Ceylon, the West Indies, and New Zealand. Where, as in warm climates, the summer season is dry the bracken simply lives on its stored-up food supply and does not start on an active life above the ground until the rains come. In more northerly climes the food material carries the bracken over the winter and enables it to develop its frond when spring arrives.

One remarkable point about the bracken is that it seems to rely almost entirely on vegetative means for propagation. In the late summer spores are freely produced in stalked cases which are developed on the underside of the leaf margins. To walk through the fern at this time is to get one's clothes covered with a golden brown dust, each particle being a living cell capable of bringing into the world a mature plant. Yet, in spite of this, it is believed that only rarely, at any rate in exposed situations, does the bracken fern increase through spore agency. Strangely enough, the spores grow freely when scattered artificially on damp soil.

One curious point in connexion with the development of the bracken is evident when the plant is under cultivation. As is the case with most ferns, the development of the spore ends in the formation of a flat green body known as the *prothallus*. On this are produced the sex organs which are responsible for the appearance on the scene of the baby fern plant. In its early days the underground habit of the bracken is not in evidence at all. It is only after the production of several leaves that the stem divides into two branches, one of which turns downwards into the soil, and never again comes up to the light. The other stem, when it dies, is never replaced, and from thenceforward the fern leads an underground existence.

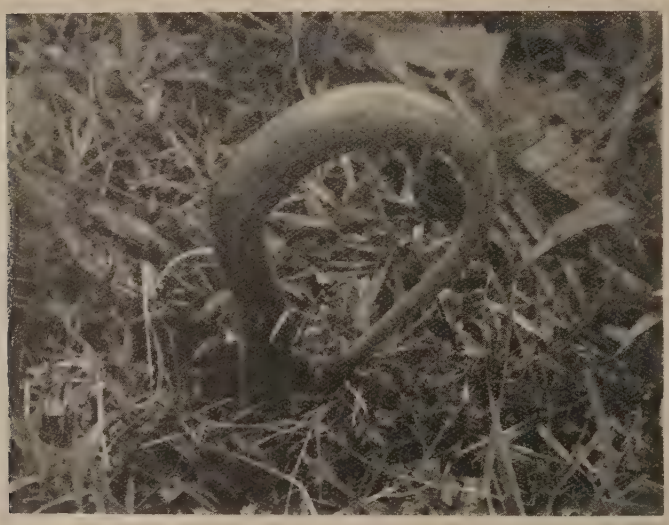


Photo: S. Leonard Bastin.

A Bracken shoot in difficulties because the top of the frond is caught underground. In the end the battle went to the persevering plant, and the stem pulled itself free.

One reason why the bracken relies to such an extent on vegetative increase is that it so often grows in dry situations. Now and again the plant is to be met with in moist woods where the spores would find the damp soil needful for their development, but such a condition of affairs is rather the exception. On the sandy heath there are few situations where the delicate spores would find congenial conditions, and so propagation in this way has been largely abandoned.

All the winter long there is nothing to be

seen of the bracken save the dead fronds of the previous season. Then, with the coming of the spring, the new leaves start to push their way up through the soil. Few things in nature are more charming than these little curled-up fists of bracken that one finds pushing through all over the woods in spring. They are of a delicate green, often tipped with the colour of old gold, and protected also in early life by a covering of soft, brown fur. The stalk is brittle, and yet it has considerable strength, like most growing things. Often the upper part of the frond will become entangled in some root, but it is rarely that the sturdy stalk is not able to wrench the expanding frond free.

In warm weather the stalk grows very rapidly, and on this page is shown an interesting record of the development of the shoot. Where there is full exposure to the light the frond of the bracken will be quite stunted, small in leaf and short and brittle in stem; on suitable soil, in the shade of woods, it will often attain a thick, luxuriant growth, some six feet or more in height, and each frond covering some square yards of ground. Then the stem is strong and juicy, and the massing fronds make such dense shade that there is little chance of growth for other weeds or plants beneath.

The light green of the fronds changes through the summer to a darker hue, and quite early in the autumn their work is at an end. The leaf has played a part in adding to the store of nutriment in the rootstock below the ground, and nothing remains for it save to die. Then comes a glorious change; from the monotone of green the sea of bracken takes on every shade of gold and yellow and brown, vying in colour with the splendour of autumn foliage above, and dying at last to a rich sienna that carpets the woods the winter through, and seems in damp weather to glow almost like a flame amongst the vivid emerald of moss and the more sombre green of the pines. Thus, for all it may be considered a hindrance to intensive agriculture, this persistent plant is not without its virtues both practical and æsthetic, and there are few but will be glad that in out-of-the-way places it will continue to spread unchecked.

Photo: S. Leonard Bastin.

How the rate of growth of a Bracken frond may be shown by a simple method of measurement. The three illustrations represent three days' growth, and each space represents two inches.

Photo: Charles Reid.

The Wild Cat (*Felis catus*), our one really fierce, wild carnivore, is no unworthy representative of the savage beasts that once prowled in our British forests.

10.—THE WILD CAT

By CLIFFORD W. GREATOREX, F.Z.S.

THE announcement in a famous daily newspaper of the recent capture of a genuine wild cat in Inverness brings before the notice of the reading public an animal that is one of the most ancient inhabitants of the British Isles.

At one time, when our island home was densely wooded to a far greater extent than prevails in the present age, our fauna included such large wild beasts as the sabre-toothed tiger, the lion, the lynx, the cave bear, the wolf, and the hyæna. To-day, not one of these fierce flesh-eaters is to be met with in a wild state throughout the length and breadth of the British Isles. Indeed, the sabre-toothed tiger and the cave bear have disappeared altogether from the surface of the earth.

We have still, however, although in already diminished and continually diminishing numbers, one really fierce wild animal—the wild cat, the *Felis catus* of scientific naturalists. This carnivore is no unworthy representative of the hosts of savage beasts that once prowled in the forests, and against which man waged incessant warfare until, after many struggles, in which he was not invariably the victor, he at length overcame brute force by superiority of intelligence.

For, it appears, no creature beneath the sun, however big or ferocious, or however swift of limb or wing it may be, can hold out for ever against the antagonism of man. Man's keener wit and skilful hands can invent all manner of deadly devices. Long before the " supreme mammal " had learnt the fearful potentialities of gunpowder, most of the large wild beasts of prey had already been crowded out of our isles. Snares and

spears were no mean instruments of destruction in the hands of our early ancestors.

The wild cat was a contemporary of the lion and of the other great carnivores that once were common in our country, and it has managed to survive them all. Its survival has been due in no slight degree to its relatively small size; the larger an animal is, the less chance it has, in the long run, of countering the persistent attacks of its arch-enemy—man. The wild cat, being a creature of only moderate dimensions—compared with, say, the lion or the bear—could resort to secluded retreats in the forests or mountains, and thus escape when threatened by a foe too dangerous to be evaded in the open. Long ago, it learnt the meaning of the gun; and it has been the use of that weapon that has done more than anything else to bring about the reduction in the numbers of this wily and agile animal. However, in spite of it, in the almost inaccessible shelter afforded by dense forest growth and vegetation-clad rocky heights, the wild cat has found sanctuary for itself and a safe retreat wherein to rear its young.

Photo: Frances Pitt.

In some respects the appearance of the Scottish Wild Cat suggests that of an exceptionally large tabby. The former differs, however, in that the body and limbs are proportionately longer, the head more massive, and the tail thicker and relatively shorter than those features of the domestic cat.

It is a bigger animal than its domestic relative, although, in some respects, its appearance certainly suggests that of an exceptionally large tabby. There are, however, various points of difference that serve as an unfailing guide whereby *Felis catus* may be distinguished from *Felis domestica*. In the wild cat the body and limbs are proportionately longer, the head appears somewhat more massive, and the tail is thicker and relatively shorter. Whereas in the domestic cat the tail tapers gradually to the tip, in the wild species it is of almost uniform thickness throughout its whole length.

The name of "British tiger" which Pennant bestowed upon the wild cat is singularly appropriate, not only in relation to the animal's fierceness of disposition—it is doubtful if a single individual of its kind has ever been tamed—but in consideration of a conspicuous feature of its coloration. The dull, yellowish-grey of the thick, rather long fur is relieved on the sides and limbs by tiger-like stripings of a dusky hue, darker in some regions of the body than in others. A dark line follows the course of the spine along the back, and the tail is heavily marked with, as a rule, nine black rings. On the face are some black spots, and the head is striped. The under-surface of the body is whitish. The soles of the feet are black.

The male has a total length, from the tip of the nose to the extremity of the tail, that falls short of four feet only by some three or four inches. Indeed, about eight years ago a specimen was shot that actually exceeded four feet by an inch and a half! The female is considerably smaller than her mate, and her fur is lighter in colour.

Not seldom individuals of the domestic cat desert the precincts of human habitations and revert to a feral mode of existence. Their final resting-place is usually known only to the gamekeeper. The occurrence of these

wanderers from time to time gives rise to erroneous reports of the finding of wild cats in unlikely places. But no naturalist is likely to confuse the two species, and the differences above are sufficient to prevent even the least zoological of readers from ever committing the blunder of writing to the Press about the amazing discovery of a wild cat in some familiar coppice by the roadside!

Photo: Frances Pitt.

The Wild Cat is a ruthless marauder. Note the expression of ferocity assumed by him when brought close up to the lens, and within a few yards of his enemy—man.

As regards its present distribution in our isles, the species is found only in the wilder and more remote parts of the Scottish Highlands; and, even here, excepting in those few localities where it is specially protected by landowners who are desirous of preventing its complete extermination, it is not often met with. Apparently, it has never been an inhabitant of Ireland. In England it lingered until a comparatively recent date in the more thickly wooded parts of the Lake District. From Wales it has disappeared entirely. On the mainland of Europe this species enjoys a very considerable range, and extends also into the forest regions of northern Asia.

The wild cat is a superb hunter, stealthy, possessed of amazing agility, and, in proportion to its size, of enormous strength. It can overcome and kill half-grown lambs and fawns, and its ordinary quarry includes hares, rabbits, grouse, ptarmigan, squirrels and all available small mammals and birds. Naturally, it is detested by gamekeepers and shepherds alike, and in the days of its comparative abundance, farmers also had every reason to do their utmost to effect its destruction. For this fierce beast was a ruthless marauder, robbing the poultry-house on every available occasion. It was undeterred by size from the performance of its fell purpose. It attacked and killed even the most valiant chanticleer, and neither turkeys nor geese were safe from its terrible onslaughts, delivered so unexpectedly and with such fatal effect.

The lair of the wild cat is made in the heart of a thicket in a hollow tree, a crevice in the rocks, or sometimes in the deserted burrow of a badger or fox. Occasionally, the nest of some large bird—a hawk or a crow—is selected; and in this case the usurper would have no difficulty in ousting the rightful occupants!

The young are born early in summer, and there are usually five or six in a litter. Baby wild cats resemble ordinary kittens; they are clad in fur of velvety softness. But, woe betide the person who handles them incautiously! Almost from the hour of birth they display a measure of that fierceness and sheer implacability that continues to develop

Photo: Capt. H. Morrey Salmon, M.C.

KITTEN OF A WILD CAT.

Playfulness and furriness suggest its resemblance to an ordinary kitten, but almost from birth the wild kitten betrays the fierceness of his kind.

with the increase of bodily stature until, in the adult, we find ferocity incarnate. When the mother's milk is no longer adequate to meet the requirements of the growing young, the devoted parent catches for her little family wild mice and small birds, attending to her charges most assiduously until they are capable of looking after themselves. Indeed, the young frequently remain under parental control until they are at least half-grown.

Photo: Charles Reid

As the Wild Cat grows up, the savage trait intensifies until it develops into ferocity incarnate in the mature adult.

There are several well-authenticated instances of the wild cat having actually attacked human beings, and, not seldom, without provocation. It is well for the safety of wanderers in lonely places that the "British tiger" *is* rare, and that it is found in only the more remote parts of the Highlands! It is much too dangerous to be a desirable neighbour, despite the fact that, from a naturalist's point of view, its disappearance is regrettable.

One writer, in exemplifying its savage disposition, narrates the following incident. "There exists at Barmbrough an ancient record commemorating the ferocity of the wild cat. The story is that Percival Cresare, a youth of distinguished family, was returning to his home from a fair at Doncaster when, as he was passing through a plantation known as Melton Wood, a wild cat suddenly leapt from the trees and attacked him. The man sought with his gauntleted hands to grapple with his foe, but the latter's sharp teeth and powerful claws were too much for him. Badly mauled, Cresare endeavoured to escape towards Barmbrough, but the cat pursued him and compelled him to seek shelter in the porch of the church at Barmbrough. Even here the creature did not relinquish the fight, but inflicted such terrible wounds as to cause the death of young Percival, who in his last struggle seems to have crushed the cat with his feet against the wall. In the morning man and cat were found dead in the porch of the church where the weird contest had ended." The writer of this narrative does not give his name, but the passage occurs in a well-known work on natural history, and there is no reason to doubt its accuracy.

Again, that renowned naturalist of the Scottish Highlands, Charles St. John, who had plenty of first-hand experience of the ways of the wild cat, makes frequent allusions to its ferocity, strength, and tenacity of life. Indeed, in regard to the last-mentioned trait, St. John concludes that if the domestic cat has nine lives, its wild relative must have at least twenty!

The wild cat prowls abroad chiefly by night; though when there are young to be fed, it is not unusual to meet with the female hunting in broad daylight. The lonely spots where it still lingers are sometimes rendered eerie beyond description by the unearthly cries of this last representative of the wild beasts of old time.

Photo: Richard Kearton, F.Z.S.

With his blunt nose and prodigious whiskers, the Water-vole resembles a kind of fantastic cross between a beaver and a seal on a lilliputian scale.

11.—THE GOBLIN OF THE GLADE: THE WATER-VOLE

By H. W. SHEPHEARD-WALWYN, M.A., F.R.Met.Soc., F.Z.S., F.E.S., F.N.B.A., etc.

MANY years have flown since I first made the acquaintance of the water-vole, or water campagnol—water-rat, as he is more generally known in rural circles, although, with his broad, blunt nose and prodigious whiskers, he resembles rather a kind of fantastic cross between a beaver and a seal on a lilliputian scale—and there is no denying that I have cherished a sneaking affection for him ever since. Let us carry our minds back—those of us who can do so—to the days when the motor-car was a *rara avis*, when the motor-bike was not even hatched, and the flying machine little more than the figment of ecstatic dreams. It was the vogue of the old " push-bike "—as it is now scornfully termed—when he who owned one regarded it as a prized possession, and *she* who rode one was regarded as no lady. The pneumatic tyre was still in its infancy, and with a brand-new *cushion*-tyred machine I thought myself vastly superior to the boon-companion on a solid-tyred bone-shaker with whom I used to scour the countryside during the holidays. There could have been few indeed of the roads and lanes within a radius of twenty or thirty miles that I did not know by heart, and many were the summer mornings that would draw me even farther afield, with hard-boiled eggs in my pocket and a butterfly-net strapped to the handle-bars.

It was an expedition of this kind that took me one day to visit a distant forest in quest of the glorious purple emperor butterfly.

Midday found me seated on a heather-clad knoll, trying to negotiate my lunch without the assistance of the cloud of midges round my head and the gigantic black ants beneath ; the smell of peat fires in my nostrils, in my ears the soft soughing of the wind among the pines, and the vision of three counties spread out in glorious misty panorama before my eyes.

Photo: Frances Pitt.

The Water-vole has been called the Goblin of the Glade, and when seen on his haunches among the reeds, he truly supports the suggestion. In such a position, with the security of his burrow-door behind him, he betrays no sign of emotion.

Presently my wandering gaze descried a distant glade, which would inevitably have riveted the attention of the curious or the lover of artistic effect. I was both, and forthwith set off hotfoot to discover what strange vagary of Nature could have evolved so mysterious and exquisite a mosaic of red and white and emerald green. Leaving the high vantage-ground of that pine-clad knoll, I lost sight of my objective for the time being, but a sense of direction carried me on through the birch-fringed spaces until I suddenly turned a corner and found myself facing a marshy sloping glade, intersected by semi-stagnant streamlets thick with compressed masses of rust-coloured scum, and dotted with patches of the most extraordinary moss that I have ever beheld. It was dense and rank, rising over a foot in height above the golden pools, here a patch of brilliant blood-red hue, there another of snowy-white, with every conceivable gradation of rose and emerald green—such was the marvellous mosaic that lay unfolded before me. At the foot of the slope the sluggish ooze seemed to culminate in a deep, silent, eerie pool, of the kind that always looks as if it must have a history. . . .

And it was there that I met the Goblin of the Glade !

Hunched up, like an old man, on his haunches beside a lichen-covered stump, motionless as the stump itself save for the waggling of his bristling whiskers as he chewed a scrap of reed-blade grasped between his fore-paws—truly might it have been some grotesque gargoyle plucked from a medieval church rather than a thing of flesh and blood pulsating with vitality and vigour ! Evidently fear did not form part of his constitution, for, although the water was barely half a dozen yards across, he betrayed no sign of emotion at my approach, nor even when I leisurely lowered myself upon a fallen trunk to watch him for a while did he so much as shift his position by a hair's breadth. Monarch of all he surveyed in his little forest kingdom, he knew well enough that his burrow-door lay within a few inches, firearms were entirely beyond his ken, so why disturb himself ?

At all events, he munched placidly on

Photo Richard Kearton, F.Z.S.

THE WATER-VOLE AT HOME.

Peeping from his burrow-door set deep in a thickly-grown bank, his blunt nose and sharp beady eyes surveyed the scene with equanimity, while his companion munched placidly under the overhanging herbage.

for several minutes before it seemed to strike him that a variation in his diet might prove agreeable. A single bound, a loud plop, and I could see him darting like a submarine through the limpid depths of the pool, each hair tipped with a bubble of air until the flashing brown form appeared vain, for the appearance of his family, but I learned later that the water-vole as a species, although not exclusively nocturnal in his habits, prefers the darkness or twilight, and I was really rather fortunate in the experience of that afternoon.

Since then I have had many opportunities

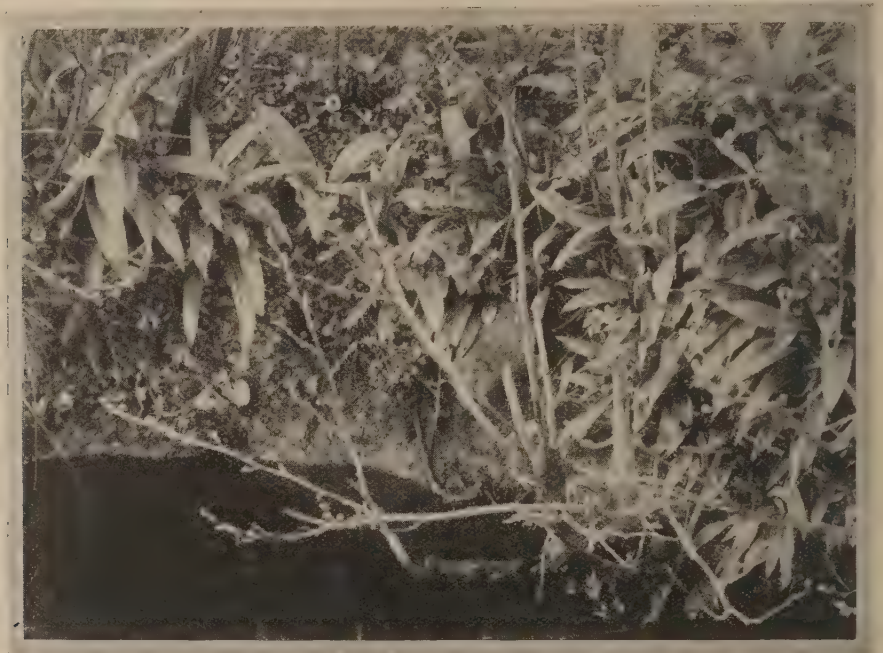


Photo: Richard Kearton, F.Z.S.

The Water-vole breeds only twice in the year, producing five or six young at a birth. Otherwise the animals might become rather a nuisance at times, for there is no doubt that their labyrinth of burrows must considerably weaken the banks of streams.

studded all over with pearls. An instant later he was gnawing away with terrific energy at the submerged stem of a "mare's-tail" plant, which he proceeded to tow ashore when severed, shook the water from his coat with a kind of odd shiver, and again sat up like a squirrel to enjoy his second course. In this position the light grey underside of his coat afforded a pleasing contrast with the chestnut-brown of the back; his ears were scarcely visible through the thick fur, and the bright eyes seemed to wink at me in conscious enjoyment as his powerful yellow front teeth stripped and peeled off the outer bark from the stem in order to get at the succulent pith within. I waited, though in

of watching them; as an undergraduate at Oxford, drifting in a Canadian canoe past the Nuneham woods on a drowsy summer evening, with not a sound to break the silence save the gurgling of the nightingales or the distant cooing of a turtle-dove; leaning on the bridge-rail beside a brook that twines its corkscrew course through a sweet Sussex garden; and yet again, reclining amongst the marigolds at Monsal Dale, the aromatic odour of bog-myrtle wafted upon the keen Derbyshire air, and the long-drawn cry of the curlew floating down from the towering, boulder-studded crag on the other side of the river. . . .

And I have come to the conclusion that

the water-vole is a happy, contented little fellow, singularly devoid of evil propensities, considering his unfortunate lineage, and, anyhow, not half as black as some have painted him. If people will persist in planting vegetables within a few yards of his lawful domain, they must take the consequences or erect wire netting. A large water-rat was once seen to enter a river-side garden where some French beans were growing, ascend one of the stalks in his awkward, cumbersome fashion, and, after severing two or three pods with his sharp scissor-like teeth, pick them up and calmly trot home again. In the winter they will feed on turnips, mangel-wurzels and other roots, and will also do a certain amount of damage by stripping the bark off the young shoots in the osier-beds. An eminent naturalist has described how he once came upon a willow bush with a number of its twigs gnawed off, and presently noticed the missing extremities lying, neatly peeled, in the water beneath. After a few moments he saw a water-vole pop out from its burrow hard by, climb the willow and gnaw off a twig, descend with it to the edge of the water, and there, seated on some crossed boughs, proceed to peel and devour the bark with evident relish.

The water-vole is not nearly so prolific as the rat. He breeds only twice in the year, producing five or six young at a birth. Otherwise, the animals might become rather a nuisance at times, for there is no doubt that the labyrinth of burrows in which they live and move and have their nests must considerably weaken the banks of streams. Although such excellent swimmers, their feet are not webbed; they possess five toes, but the thumb in the fore-feet is unusually short.

It would hardly be fair to pass on without taking the opportunity to refute the blackest impeachment that has at one time or another been levelled at the reputation of our friend the water-vole. He has frequently been accused of destroying fish-spawn, and even young fish—in fact, an acquaintance of mine, who owns a small trout-stream in the west of England, used to swear that he had frequently watched the rascals with opera-glasses from his bedroom window, and had thus managed to catch them *in flagrante delicto*. I expressed surprise, for the water-vole is almost as strictly vegetarian in his tastes as the beaver, to which, as a matter of fact, he is nearly related. My informant also changed his opinion after shooting one of the thieves. It appeared that he had forgotten the existence of some neighbouring corn-ricks, and at some distance it would have been easy to mistake a water-vole for one of his destructive cousins, the common brown rat. And no doubt this is not the only case of an innocent creature being saddled with a bad reputation on account of his unfortunate resemblance to a beast of genuinely destructive character! The common rat possesses a distinct eye for his own comfort, and during the colder months of the year likes to have a dry roof over his head. Spring, however, has the same effect upon him as it has upon Boy Scouts, and he is seized with a desire for camping out. Being a thirsty creature, competition runs high for the possession of some sequestered river bank, where he constructs innumerable burrows and enjoys the time of his life pillaging the neighbourhood in the blissful assurance that the credit will accrue to our poor little goblin of the glade.

Photo: Richard Kearton, F.Z.S.

A Water-vole will slip out from his burrow, climb a willow and gnaw off a twig, and descend with it to the edge of the water, there to nibble the bark with evident relish.

Wild Flowers and Their Ways

11.—SOME BRITISH BOG-PLANTS

By BENJAMIN HANLEY

THE wild plants which flourish best in a bog or morass seem to have a beauty all their own. Possibly this is because in their waterlogged surroundings they are frequently difficult to approach with safety,

Photo: B. Hanley.

Noticeable at any time are the flowers and sword-like leaves of the Yellow Iris (*Iris pseudacorus*). The buds will continue to open even when gathered.

and in such cases one has to be content to admire from a distance. It is not only the flowers which seem singularly beautiful, even the foliage shares in this delicacy of form. Take the case of the horse-tail, its feathery whorls have an outline hard to surpass in beauty.

At one time in the history of our land bog-plants were exceedingly common; now, however, owing to the efficient system of drainage which has converted useless bog-land into profitable arable or pasture, and so destroyed the natural conditions under which the plants flourished, many of the erstwhile common species are only to be found in odd places on the moors or by swampy parts near the river and lake, but in such situations they still hold their own.

A particularly striking bog flower is the well-known marsh marigold (*Caltha palustris*) which appears in the early part of the year before wild flowers are really plentiful. The brilliant flowers—usually known as "king cups"—must ever arrest the attention, whilst its large handsome leaves form a luxuriant background to the deep gold of the blooms.

Common in similar situations, although loving even deeper water, is the yellow flag or iris (*Iris pseudacorus*), a plant whose sword-like leaves are noticeable at any time. In May, however, its blooms make such a show that few can resist the temptation to gather a bunch, although within an hour of being plucked they will have withered out of all semblance to their original beauty. The buds, however, will continue to open even when gathered.

Less common is the marsh trefoil (*Menyanthes trifoliata*), which is often known as the buck-bean or bog-bean. It has, however, no relationship with the beans, and gets its common name because the large trifoliate leaves are very much like the broad bean of our gardens. In reality, the plant belongs to the gentian family. The erect spikes of bloom are lovely indeed, the flowers are white, tinged with pink on the outside and fringed with white filaments which veil the little red stamens. To see the plant in flower is worth a long walk, and its closer acquaintance well worth the

Photo: E. Hanley

A striking bog-plant is the Marsh Marigold (*Caltha palustris*) with its brilliant flowers known as "King Cups."

Photo: E. Hanley.

The erect spikes of white bloom of the Marsh Trefoil (*Menyanthes trifoliata*) are no less lovely among bog-plants, though less common.

Photo: B. Hanley.

Commonest among marsh flowers is the Ragged Robin (*Lychnis floscuculi*). At first sight it suggests a torn specimen of a campion, but although it belongs to that family, its appearance is entirely due to natural growth and not to accident.

inevitable price of wet footgear. A glance at the accompanying illustration will enable one to recognise the plant. The leaves have an exceedingly bitter flavour and are frequently used by herbalists in country districts for making a kind of medicinal tea, a beverage said to be a cure for liver and kindred complaints. I know of a marsh where a very large tract is covered with this plant, and herbalists visit the place every spring to gather the leaves, coming from a distance of over twenty miles. On some occasions the leaves have been used for brewing a bitter beer.

One of the common flowers of marshy lands is the ragged robin (*Lychnis flos-cuculi*). At first sight one might take this flower for a torn or battered specimen of a campion, but although it is really of the campion family, its jagged petals are a natural production and not due to accident or the vagaries of the wind. It is a beautiful flower, and well worthy of a place in a damp corner of the flower garden.

No more interesting botanical sight can be found than a patch of cotton grass or cotton sedge (*Eriophorum polystachion*) in full flower. Our photograph can give but a poor impression of this striking feature of a marsh where these silken tassels flourish, waving with the slightest suspicion of a breeze. I wonder the silky material has never been put to any practical use, for it could be gathered in large quantities. The photograph here reproduced shows but a small portion of a stretch several acres in extent, and when the seed is ripe and the downy substance begins to fly in the wind all other vegetation near is wellnigh covered with it.

Mention must be made of the bog moss (*Sphagnum*), for it abounds in any bog or

Photo: B. Hanley.

The Spotted Orchid (*Orchis maculata*) is one of the most handsome and most plentiful of British bog-plants.

Photo: B. Hanley.

COTTON SEDGE IN THE MASS.

No more striking feature of a marsh can be seen than a large area of Cotton Sedge (*Eriophorum polystachion*) in full flower, its silken tassels susceptible to the faintest breeze.

swamp. The growth of successive generations of moss results in a thick carpet being formed, and the level is gradually raised until it is like a gigantic saturated sponge that will not bear one's weight but sinks one ankle deep in the water. In the midst of this emerald moss the sun-dew (*Drosera rotundifolia*) grows, and its ruddy rosettes of leaves at first sight appear almost like the petals of some unknown flower. That they are not petals, the unlucky insects entangled in the viscid juices that exude from every leaf hair know to their cost.

Not far away probably the bog asphodel (*Narthecium ossifragum*) may be discovered. This is the only British representative of the species. Its six-pointed yellow flowers grow in profusion on the flower-stalks. After the flowering season the blooms are followed by a crop of orange-yellow seed capsules, and at that time the grasslike leaves turn from green to deep vermilion

Photo: Henry Irving.

The six-pointed yellow flowers of the Bog Asphodel (*Narthecium ossifragum*)—the only British representative of its specie.

A search is almost bound to reveal a few flower-stalks of the handsome spotted orchid (*Orchis maculata*), one of the most plentiful of our wild orchids, but no less beautiful on that account, and few can resist the temptation to take a stalk or two home as a reminder of their happy ramble in bog-land.

The Water Soldier (*Stratiotes aloides*) has no permanent attachment: the entire plant in summer floats at the surface of the water, but in winter it hibernates in the comfortable bottom mud of the ditch.

12.—THE WATER SOLDIER

By EDWARD STEP, F.L.S.

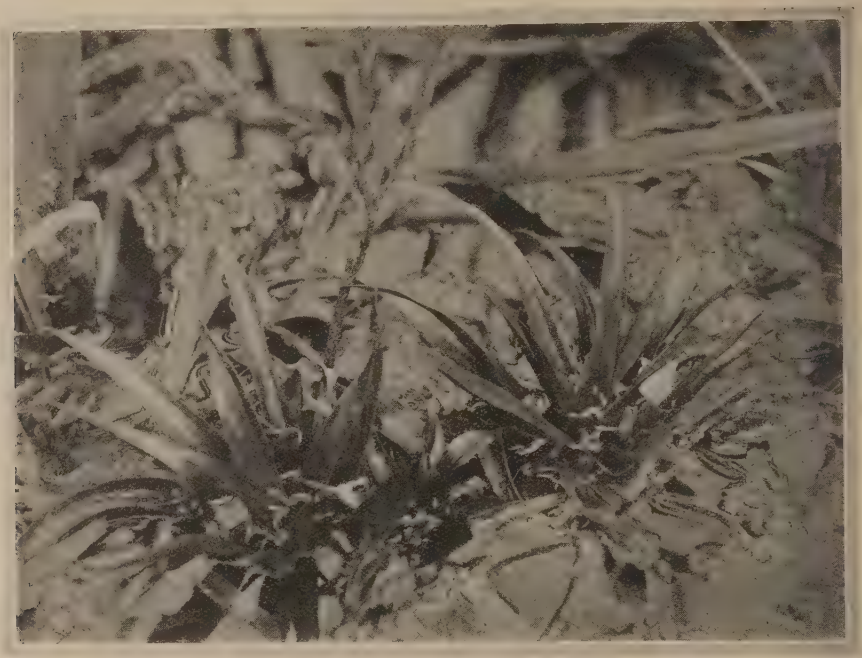
With photographs by Henry Irving

THE widely current notion that plants are uninteresting because they are sedentary and cannot "do things" as animals can, requires a considerable amount of modification to make it fit the facts. Alexander Pope's lines—

> *"Fixed like a plant in one peculiar spot*
> *To draw nutrition, propagate and rot,"*

do not apply to all plants. There are many plants that do things of an astonishing character, even though they have fixed themselves in an appropriate situation. Locomotion, after all, is not the only desirable ideal. Primitive plants still possess the power of journeying through the waters; but the higher forms that through ages of striving have attained to a stature and a permanency that make all animals appear puny and ephemeral by contrast, appear to have worked for a fixed address and a quiet life among their own kin.

But there are still plants that have reached a high evolutionary stage without resorting to a permanent anchorage: they attach themselves to the earth only temporarily and to serve their own ends. As a native example of this type, let us consider the water soldier (*Stratiotes aloides*), which is a common plant in the quieter



A closer view of the floating Water Soldier, which consists of a dense cluster of stalkless, brittle, sword-shaped leaves spread out at all angles, and varying in length from some six to eighteen inches.

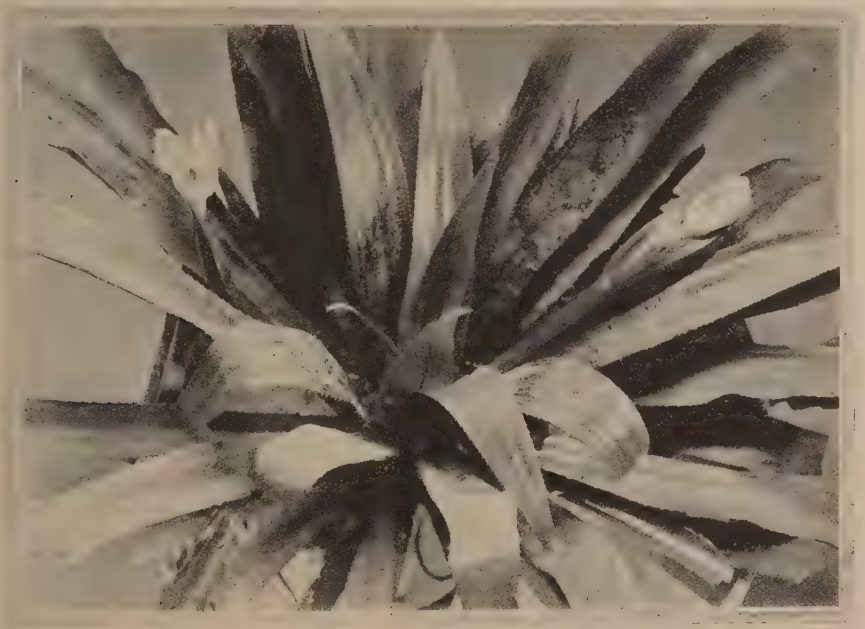
waters of the eastern counties, especially in the ditches of the Fen districts. In the summer this aquatic plant floats at the surface of the water, but in the winter it is not in evidence. Like many animals it goes into hibernation, retiring in autumn to the comfortable bottom mud and rising to the surface again to enjoy the air and sunshine in spring. Aquatic plants like the water-lilies really live in the mud, in the form of a stout, creeping rootstock from which arise at intervals their floating leaves on very long stalks. The water soldier is without any permanent attachment. The entire plant floats on the surface, and can drift freely with the breeze or on any gentle flow of the water. It consists of a dense cluster of stalkless, brittle, sword-shaped leaves which spread in all directions. These vary in length from about six inches to three times that length, their edges armed with sharp-pointed teeth like the cutting edge of a saw. From the base of the plant a number of roots hang in the water. The " habit " of the plant and the shape of the leaves present something of the appearance of an aloe ; so one of its names is water aloe, just as water soldier was suggested by its bearing swords.

About midsummer there arises from among the leaf-bases a short and erect stout stem with an oval swelling at its upper extremity. The latter is a spathe or envelope covering the flower-bud or buds, and in a little while these issue from it. The flowers are white, about an inch and a half across when widely open. One plant may produce only a single flower from its spathe ; another will have two or more. The solitary flower is a female—the seed producer. It contains an egg-shaped ovary surmounted by half a dozen styles, each branching into two stigmas. Around the ovary are numerous stamens, but nearly all are more or less imperfect ; they have no anthers and, therefore, produce no pollen. They have their use,

however, for they have been converted into nectar-glands with the object of attracting insects.

In the second kind of flower the ovary is small and divided, but twelve of the numerous stamens bear anthers and pollen ; the imperfect stamens here also have become nectar producers. This, then, is the male flower, whose mission is to supply pollen for the fertilization of the other form. When this has been effected, the ovary develops into a flagon-shaped, juicy berry which bends over to one side. Like the white water-lily the water soldier finds that its fruit and seeds are developed better under water, and when fertilization has taken place the plant descends to the bottom for this purpose. When ripe, each seed has a jacket of gluey material, and when the fruit breaks up and sets them free the jacket absorbs much water and swells up, buoying them to the surface, where they are dispersed by air currents. As a matter of fact, few of the plants produce seeds at all, the water soldier like most other aquatic plants relying upon another method of propagation.

In any case, after flowering it sinks to the bottom, and there issue from among the bases of the leaves from eight to a dozen runners which push along through the mud, and at the end of each a bud develops into a young plant. Towards autumn the old plant with its circlet of youngsters rises to the surface again, like a duck with her brood of ducklings. The new plants grow for awhile, then the connecting runners decay and they are all set free to drift apart. Before winter, however, they all drop to the bottom, anchor themselves to the mud, and wait in safety until the spring. When the time comes for reappearance they ascend by filling part of their tissues with gas.



The Water Soldier may produce only a single flower from its spathe, or it may have two or more. Where a single flower is produced, it is the female or seed producer.

Photo: G. Clarke Nuttall, B.Sc.

A Foxglove group. Notice the beautiful tapering pyramid of the central plant. These plants are at the commencement of flowering, for the open bells are low on the spike.

13.—THE FOXGLOVE AND THE BEE

By G. CLARKE NUTTALL, B.Sc.

ONE could get long and entrancing vistas through the little wood of oak and silver birch, for it was thinned by small clearings into which the July sun shone unhindered; vistas, whose charm of delicate greens and tender browns was enhanced a hundredfold by the tall spires of foxgloves which lit up the wood as with endless tapering rose-pink torches. Indeed, the place seemed a foxgloves' paradise, for even the hedgerows on either side of the lane that led to it were thronged with a procession of similar roseate spires of "proud foxgloves' finger bells," all in the happiest possible condition. Among the flowery belfries bees were humming with the utmost content as if they, too, had found their paradise, and the low music of their humming made a delightful trinity with the colour and the sunshine.

No wonder there was a special charm in that sunny woodland, for there are few flowers in the whole of our English countryside more handsome than the foxglove, perhaps none which is both as stately and as common. Such a plant, for instance, as the glorious candelabra-like hoary mullein of Norfolk, which might well claim precedence, is such a rarity that it is given to few to see it in all its primrose splendour. Let us, then, examine closely the foxglove with its visiting bees, and we shall see that its shape, its internal structure, everything indeed about it, is built on lines to attract and utilize great humble bees. It is emphatically a "bee flower," and the bees

Photo: Riley Fortune, F.Z.S.

Tall spires of Foxglove lit up the clearings of the wood as with endless tapering rose-pink torches. Indeed, the place seemed a Foxgloves' paradise.

are most willing partners in the schemes of the plant.

Taken as a whole the plant is a tapering pyramid. There is a beautiful and typical example in the centre of the group of Foxgloves shown in the first photograph. At the base on fairly long stalks are large downy leaves from which is derived the drug digitalin, so much valued as a heart stimulant. In the centre of the leaf rosette rises the flowering stem, three, or it may be four, feet high, and on the lower part of this stem on shorter stalks are a few smaller leaves. The upper part is a spike of flowers and buds in all stages, the oldest flowers at the bottom and the rest

graduating in age up to the youngest and smallest of buds at the tip. If the plant has been blooming some little time,

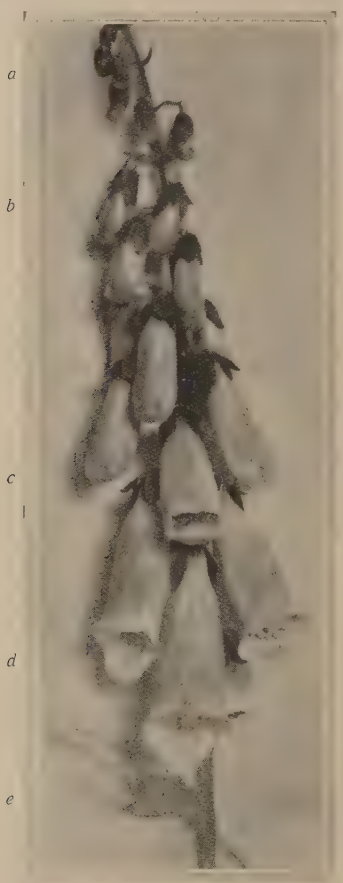


Photo: G. Clarke Nuttall, B.Sc.

A Foxglove spike showing: (*a*) tiny buds enclosed in green sepals; (*b*) buds with a long closed petal bag; (*c*) the petal bag beginning to open; (*d*) its lower part growing out to form a platform, and the eye-spots showing; (*e*) a seed-case off which the petal dress has fallen.

below the flowers will be seen the fruits forming, also in all stages.

Let us begin our examination at the tip, because in passing from blossom to blossom down the stem, we are likewise tracing the life history of any one flower. And first we must notice that all the flowers hang on one side of the stalk and always on that side on which they will be most easily approached by the bees—so considerate for their visitors are they we never find them turned towards the hedge or a tree-trunk, for example. At the very top of the stem are tiny buds covered by green sepals. A little lower, out of the sepals, begins to project what looks like a purplish pink bag; this increases in size as we pass down the stem until it may be an inch long. And then we come to one or two flowers where this bag is opening at its bottom end, and in an older one still the mouth is wide open, and we can peep within and see, dimly, that the flower is a rosy cave whose floor is gaily covered with red and lemon spots—"eyespots" they are called. The floor protrudes a little and, eventually, in a still older flower, it forms a small platform on which a bee can alight at the entrance and the bright eyespots apparently direct him inwards. Some long velvety hairs stand up just within the mouth and form a small barrier which keeps out little marauding insects. On the roof of the cavern are five white lines running its length.

At this stage, to learn more it is necessary to slit up a flower. This done, we find that four of these white lines are the stalks of four stamens attached at the farther end of the bell; across each of their tops, like a T, is a small oval box. Two of these stalks are longer than the other two, so that two of the boxes lie behind the other pair. The central white stalk runs right back through the flower to the remote end where it is attached to the seed-box which is at the top of the drooping bell. In a little older flower we see that a curious thing has happened, the stamen heads are no longer across the stalks but lie in a line with them; further, they have opened, and flowery pollen is pouring out from them. Meanwhile the central column has lengthened and its tip is beginning to split into two parts. Then at the bottom of the series of flowers are one or two on which the petal dress is hanging loosely and, maybe, in the act of actually slipping off, as a skirt slips off a lady, and last of all are naked seed-cases each with just one long white column; the stamens are, of course, carried off by the petals.

Having thus seen all the stages in the life of a foxglove flower, a life that lasts about six days, let us see how the humble bee works in with it, an unconscious partner, but one without whose co-operation all would be in vain. Watch one of these big fellows approach—he always makes for the lowest flowers first and works upwards. He alights on the platform and strides over the hairy barrier as if it did not exist, and, indeed, to all intents and purposes it is non-existent for him; it is only meant to keep out lesser fry. He pushes up the flower, his burly body just exactly filling it as he sips at the honey which he finds in a ring round the seed-case, and his back becomes coated with pollen grains from the open stamen heads up in the roof. When he has drunk his fill he backs out and makes his way to the flower just above. Here, in scrambling in, his back, just where the pollen grains lie, rubs on the open tip of the receptive column and transfers some of the grains to it, and these, passing along the column, fertilize the little waiting seeds in the seed-case far above. Again he backs out with a fresh deposit of pollen, and so he goes on from flower to flower, giving and receiving, until he comes to the closed buds where he cannot enter, and then he leaves this spike of flowers to begin afresh at the bottom of another. Both bee and plant are satisfied: the bee with the honey, the flower with the successful carrying out of its plan for fertilization.

Photo: G. Clarke Nuttall, B.Sc.

Leaves of the Foxglove (*Digitalis purpurea*). From these is extracted the drug "digitalin," so much used nowadays as a heart stimulant

But the foxglove does not risk *all* upon the caprices of a bee, even of an imposing humble bee. When the petal dress slips off at the last it drags the stamen heads over the cleft receptive column-tip, which tip lay beyond them, and thus this is well dusted with the flower's own pollen. If it was already fertilized no harm is done; if it was not, then now it is.

The quaint teapot-shaped fruits become dry and brown as autumn comes. Eventually they split and the swaying of the stem in the wind jerks out myriads of minute seeds. It has been reckoned that a single foxglove plant in one season will

produce over a million seeds. Happily their rate is low, or one might have too much of a good thing.

There are other insects besides bees that have found a use for foxglove bells, though they, unlike the bees, do not repay for benefits received, and these are a multitude of little flies and such-like that on cold and wet nights creep into the petal caves for shelter and protection. Here they not only find a dry and snug refuge but also a warm one, for the air within is always a trifle warmer than the air without, and this slight variation in temperature may mean all the difference between life and death to a small fly.

But it is not only flies that lurk in the rose-purple bells of the foxglove; everyone who knows anything at all about fairies knows well that these flowers are one of their best-loved homes; thus Hartley Coleridge speaks of elves that "sweetly nestle in the foxglove bells," and many another poet has had this fact in mind. The very name of the plant emphasizes its connexion with fairyland, for fox is just a corruption of folks—"folk's gloves," that is, the gloves of the "Little Folk," the fairies; surely a more comprehensible allusion than to the gloves of a fox. Still better, it is suggested that foxgloves was originally "folks gleown," and "gleown" is a peal of bells, and what can we imagine better as the belfries of fairyland than the tall spikes of the foxglove?

Photo: G. Clarke Nuttall, B.Sc.

From flower to fruit in a Foxglove. The petal dress slips off whole, carrying the stamens with it. The seed-case is left naked—the column withers. The case grows, becoming dry and brown, and eventually splits, when many minute seeds are jerked out by the wind.

A foxglove plant lives, as a rule, two years, that is, it is a biennial, but sometimes its roots carry on and throw up flowers for three, or even four, years. In addition to its prevalence as a wild plant, it is greatly cultivated on drug farms for the sake of the drug digitalin which is extracted from its leaves, and which gets its name from the botanical name of the plant—*Digitalis purpurea*. On these farms one may see whole fields of the plants growing in rows as if they were so many cabbages. But the medicinal aspect of the foxglove will be dealt with later in an article on the medicinal plants of Great Britain.

The nearest relatives of the foxgloves are the snapdragon (also a humble bee flower, for nothing smaller can force open its closed box of a blossom), the mulleins, the veronicas, the toadflaxes, the figwort, and a little group of rather disreputable cousins—bartsia, eyebright, louse-wort, cowwheat and the common rattle—which have taken to supplementing their resources by thieving from their neighbours. Another relative, not long ago an alien, but now admitted into our flora, is the yellow mimulus, which, introduced from North America about a century ago, has made itself very much at home in our brooks and rivers. Garden relatives of the foxgloves are the calceolarias and the pentstemons.

Photo: Capt. H. Morrey Salmon, M.C.

A young Herring Gull—one of the typical British water birds—has the same kind of webbed feet as the ducks, although they belong to widely different families. The webbing joins up the three front toes.

27.—SWIMMERS, WITH AND WITHOUT WEBBED FEET

By CHARLES S. BAYNE

DUCKS and seagulls are our typical water birds and, though they belong to widely different families, they both, nevertheless, have webbed feet. What is still more interesting is the fact that they have the same kind of webbed feet. Their three front toes are covered and united throughout their full length by a continuous sheet of tough skin, and their hind toes are so small and so placed as to be quite useless or are missing. To the average observer, who has not, of course, made a close study of bird life, that may seem to be the only possible kind of webbed foot, for, as a rule, birds have four toes, three of which are usually in front, while the fourth, or more properly the great toe, is turned behind the heel, and in such a position that it could not conveniently be connected with the others by a web.

In another family, however, which is more ancient than either the duck or the seagull, and which includes among British birds the cormorant, the shag and the gannet, there is another type of webbed foot. In this the hind toe is long and is bent round

inwards till it occupies much the position of the human thumb when fully outstretched, and the web is extended backwards from the first toe to meet it. As the fifth toe is, of course, missing, and the fourth or outer toe is the longest, this gives the foot a very marked one-sided appearance. Whether there is any advantage in this extra webbing is doubtful. The cormorant is a swimmer and hunts its prey under water. The gannet, on the other hand, spends most of its time on the wing, capturing fish by plunging like a thunderbolt upon them from a great height, and never settling on the water except to rest or to sleep. So practically it never swims, and its webbed feet are of no service to it. We must presume, therefore, that both gannet and cormorant are descended from a common ancestor which was a swimmer.

However this may be, it is certain that these birds represent a very ancient family, and it is interesting to find that other families of water birds which rose to distinction at a later period have tended to develop the three-toed type of foot. Some, like the duck and the seagull, have acquired webs between the three front toes, but others have evolved different kinds of paddle blades which are equally efficient, while some have so far found the bare toes sufficient for their needs.

A study of these various species brings to light some very interesting facts. For example, one type of foot is not limited to a particular family. Ducks, seagulls and divers all have webbed feet though they belong to widely different families, and coot, grebe and phalarope have lobed toes, yet are not in any way related. Again, within one family both types may be found.

The phalarope belongs to the wader family. The majority of its relatives make their living by running about on the foreshore at low water and picking up worms, small shellfish, and shrimp-like creatures which they find on or under the mud or swimming about in the pools. In their hunting they wade freely, and in doing so they sometimes get out of their depth. As

Photo: Stanley Crook.

In the case of the Mallards, members of the duck family, the hind toes are so small and so placed as to be quite useless. A continuous sheet of tough yellow skin unites the three front toes throughout their full length.

a rule, the moment this happens up go the wings and the bird flies off, usually alighting on dry land and feeding there for a while before venturing again into the water. But occasionally it swims, and when it does so it swims well. Even the curlew, one of the most unlikely of all the waders, is a good swimmer when he cares to try. Yet his legs and feet, like those of most of the family, are just good wading feet and are not in any way specially adapted for swimming. A wader's feet consist of three front toes at the end of a long leg, and either no hind toe or one so small that it does not count.

The avocet, however, which at first sight is as unlikely a swimmer as the curlew, has partially webbed feet. Its toes are united after the manner of the duck's, but the fore edge of the web is deeply scalloped. The food of this bird consists chiefly of the minute animal and vegetable forms that swarm everywhere in water, and it secures sufficient quantities of them by sweeping its long, upturned bill to and fro just under the surface as it wades in the pools. As, however, this food is to be obtained as readily in deep water as in shallow water, the bird has every inducement to swim, and does so frequently, and when wounded and in danger of capture it will dive.

The phalaropes are a branch of the wader family that have gone a stage further. They earn their living by swimming rather than by wading, and their feet are very remarkable. They are partly webbed and partly lobed. The outer toe is united to the middle one by a scalloped web, but the other side of the middle toe bears three

Photo: Henry Willford.

Another type of webbed foot appears in the Cormorant. The long hind toe occupies much the same position on the foot that the outstretched thumb does in the human hand, and the web is extended backwards from the first toe to meet it.

rounded lobes of skin, one on each joint, and the inner toe is lobed on both sides. The birds swim easily and gracefully, and are as buoyant on the water as a gull or a duck. They feed on insects which they pick up from the surface of the water or snatch from the reeds or other water reeds.

In two other families of British birds lobed toes have been developed, namely, the grebes and the rails. The grebes are related to the divers, which have webbed feet. The divers have become so highly specialized as swimmers that they cannot walk on land. When they come ashore to rest, or visit the nest, they can only shuffle along the ground with the greatest difficulty. Their feet are like the duck's; their first and third toes are united to the second by a web. On the foot of the grebe, however, each toe has a broad lobe or flap of skin on both sides, and between the toes these flaps are united only in the angle. The claws also are flattened out till they have the appearance of nails, and so serve also to offer resistance to the water when the foot is thrust backward. When the foot is brought forward again, the toes are held one behind another so that the resistance may be reduced to a minimum. This method of "feathering" is also adopted by the divers, whereas ducks and other web-footed birds accomplish the same end by drawing the toes together.

Among the rails the coot has lobed feet. These differ from the grebe's, however, in that each joint of the toes is lobed separately on both sides, and between the toes the lobes are not united anywhere. Now the coot is an open-water bird. Its favourite haunt is a lake of considerable size, and there it spends most of its time swimming and floating, now and again diving to secure portions of the water weed on which it feeds. It may lurk among the reeds, and there it builds its nest, but it seldom ventures on land, though when it does it walks well. When danger threatens, it seeks safety by swimming to the centre of the lake, or, if that is narrow, well towards the other side.

The waterhen, or moorhen as it is commonly but incorrectly called, is a close

Photo: Capt. H. Morrey Salmon, M.C.

The Coot is an open-water bird, seldom venturing on the land, although it walks well. It has lobed feet, and between the toes the lobes are not united anywhere.

Photo: Stanley Crook.

WATERHEN FEEDING YOUNG.

The feet of the Waterhen are neither webbed nor lobed, but there is a narrow strip of membrane extending from root to tip of each side of every toe, which aids the bird in swimming.

Photo: Capt. H. Morrey Salmon, M.C.

A Little Grebe or Dabchick has lobed toes which have been developed in this family as in the rails. Each toe has a broad lobe on both sides, and between the toes these flaps of skin are united only in the angle.

relative of the coot, but instead of venturing out into the open water of large lakes it prefers to hug the shore, and haunts small ponds and also streams. A good deal of its time is spent on the banks, where it steps about quite openly, picking up worms or insects and seeds or other vegetable food, and it even climbs among the branches of overhanging bushes to eat the berries or anything else suitable it may find there. Indeed, as a rule it is more venturesome on land than it is on the water, for it may wander into the fields to a depth of forty or fifty yards. But whether it is on land or on water, it makes for the bank at the first sign of danger and there hides.

The waterhen swims and dives well, but its progress in the water is jerky. At each stroke the head is thrust sharply forward, and as quickly withdrawn. The impression it has always given me is that instead of paddling like the duck, and so sailing smoothly as a boat, it simply walks in the water.

If you were to see this bird walking on land at close range, as is often possible in St. James's Park when the lake is full, you would notice that its feet are neither webbed nor lobed. They are just like the feet of the barndoor fowl, except that the toes are unusually long for the size of the bird. If, however, you were to take the bird in your hand and examine its feet you would find that there is a narrow strip of membrane running continuously from root to tip of each side of every toe. When the bird is swimming these flaps must spread at each backward stroke of the feet and fold inward as the leg is drawn forward again.

The water rail is another member of the same family, but it is much more shy than the waterhen, and though it is not uncommon in suitable localities and is conspicuously coloured, it is seldom seen except by those who go to search for it and know beforehand where to look. Its habit is to skulk about in the security of the marshy reed

beds that exist on the margins of so many English lakes. But it enters the water freely, though always under cover if possible, and when it does so it swims well, with the same jerky motion that is so characteristic of the waterhen. Yet it has not even narrow flaps on its toes to aid it. Indeed, its feet do not differ in structure from those of its cousin the corncrake, which keeps strictly to dry land.

So in this group we see a progression, according to habit, from the simple foot of the purely land bird to the well-equipped paddle of the purely water bird.

I have no idea to what extent, if at all, the feet of the kingfisher are utilized when the bird plunges to secure its prey, but whether they are or not, they look as if they might be. They are quite unlike the efficient grippers of other perching birds, and they are not webbed, lobed or flapped. The outer toe is joined to the middle one throughout the greater part of its length, and the inner one is similarly attached for about half its length. So the foot would serve quite well as a swimming organ if it were required for that purpose, but when the kingfisher plunges into the water its immersion is only momentary.

Our most astonishing water bird, however, is the dipper. This charming bird, which at a distance looks like a large wren in a dress suit with a white shirt front, frequents fast-running streams with rocky beds. It is, therefore, found in hilly and mountainous districts. Its food consists of water insects, and especially the grubs which are more or less sedentary. These it obtains by wading in the shallows or by walking deliberately in over its head, or by plunging into the deeper pools from the rocky margin or from a stone in mid-stream. So far as it goes there is nothing very remarkable in that feat, because other birds do similar things, but it becomes astonishing when we learn that this pert little fisherman has the feet of an ordinary percher, with no special adaptation for swimming. Yet he is able to swim along the bottom of a pool and pick up larvæ from among the stones. The secret of this performance is that he swims with his wings instead of with his feet. As the water is generally clear, it is easy to watch him from an overhanging bank.

Photo: Stanley Crook.

A young Dipper attending to his toilet, and showing to advantage his white breast. The black legs, toes, and claws of this pert little fisherman are those of the wader and ordinary percher, with no special adaptation for swimming.

Photo: A. M. C. Nicholl M.B.O.U.

The Robin's song is thus represented by Dr. Garstang:

Chir'ri-tew ! Ir'ri-tew !
Wis'-yoo, Wis'-yoo !
Wée !-Swée !-Tew-ay' !

Tew, tew, tew, Psée !
Chirri-weé ! Tyo-tó !
Se-Wis'sy-wissy, Wis'sy-wissy, Weé !

28—WHAT THE BIRDS SING

By EDWARD A. ARMSTRONG, B.A.

THE subject of bird-song is so immense and so little investigated that it requires a certain audacity to deal with it at all, and especially within the limits of a short article.

There seems little doubt that the songs which we hear in woodland, field, and hedgerow have been developed through the ages from the one or two grunts or harsh calls indicating hunger, love, or fear, of the utterance of which we may suppose the earliest reptilian birds to have been capable. With the improvement of the organs of flight and the consequent attainment of greater ease and swiftness in locomotion, and the greater security which the power of flight conferred, birds obtained that leisure to cultivate the arts which facility of transit seems to be bringing so slowly to man. At first the main impulse towards the development of a varied vocabulary would no doubt have been the birds' necessity of overcoming the difficulty of keeping in touch with one another and giving warning of danger. But the attainment of the power of flight meant, above all, intervals of leisure amongst the stern duties of life, and, secondly, security, such that the bird might take its ease and "make a joyful noise" without the certainty of being devoured by some creature attracted by the unwonted jubilation.

Investigators have shown that the song of a bird is just a very refined elaboration of its call-notes. The nightingale and blackbird have expurgated crude noises from their songs to a wonderful extent, but in the songs of wren and sedge-warbler the affinity between song and call—or alarm—note may be easily traced.

Photo: Capt. H. Morrey Salmon, M.C

LITTLE GREBE, OR DABCHICK.

Mr. H. J. Massingham's version of the Dabchick's "song" is—"a kind of silvery yodel, wild and of the water, watery."

It is doing the bird a great injustice to suppose with some biologists that bird-song is in essence entirely utilitarian, a device to attract a mate or defy a rival.

Music, it would seem, plays very much the same part among birds as among men. Why do people sing in their baths? Simply because overflowing life seeks an outlet, energy bubbles over in the form of song. Similarly a very great deal of bird-song springs directly from pure *joie de vivre*. Listen to the starling as he claps his wings and cackles on the chimney-pot, or to the wren or whitethroat skipping from twig to twig, or to the skylark. They sing because they are in love with life and full of vigour, and because they have the power to appreciate song. They express the sentiments which S. R. Crockett puts into the tuneful throat of the thrush:

All is sweet and pure and good!
Twilight and morning dew.
I love it, I love it,
Do you, do you, do you?

That well-known little poem "Vespers" expresses with delightful insight the disinterested nature of a bird's song.

When we recognize that neither the poet's sentimentalism not the biologist's barren mechanism is true to the bird's nature, we are free to take the *via media*, which is, that the bird is a very "human" atom, enjoying life intensely, with emotions corresponding to our own and interests not so very different.

Representations of Birds' Songs

The methods of representing and interpreting what the birds say and sing may be grouped under four heads. 1. By music, vocal or instrumental. 2. By means of syllables arranged to simulate the birds' utterance. 3. Prose description; and 4. Onomatopœic poetry—that is poetry which represents the bird's song in words that resemble the sounds uttered by the birds. On the whole, I believe that the last named gets closest both to the utterance of the bird and the spirit in which it makes that utterance.

1. This was probably the earliest mode of representing notes of birds. Imitation of the cries of birds and animals by savages was widespread, it provided a means of calling up game and a method whereby the members of a tribe could keep in touch with one another without provoking the suspicion of the enemy. Successful for imitating a few call notes, this musical method is a failure when we attempt to represent actual song by its means. We have only to try over, either on the flute or the pianoforte, the notations which have been attempted of such song as that of the thrush to be convinced of its inadequacy.

The Syllabic Method

2. A few illustrations will make the principle of this syllabic method plain. The nightingale's song has been rendered:

Tiuu tiuu tiuu tiuu—Spe tiuu zquo—tio tio tio tio tio tio tix—Qutio qutio qutio qutio—Zquo zquo zquo zquo—tzu tzu tzu tzu tzu tzu tzu tzi. Quorror tiu zqua pipiquisi zozozozozozozozozozo. —Zirrhading! etc., etc.,

and that of the skylark:

Swee! Swee! Swee! Swee!
Zwée Zwée-o zwée-o Zwée-o!
Sis-is-is Swée! Sis-is-is Swée!
Joo! Joo! Joo! Joo!
Jée-o! Jée-o Sissy-sejoo!
Jit, jit, jit, jit, jit, jit! Dzóo!
Zee! Wee, wée, wee! Sis-is-is-Swée!
Swée-o, Swée! Swée-o, Swee!
Swée, swee, swée, swee, swée, swee! Swée!

The robin's song is thus represented by this method:

Chir'ri-tew! Ir'ri-tew!
Wis'-yoo, Wis'-yoo!
Wée l-Swée l-Tew-ay'!
Tew, tew, tew, Psée!
Chirri-weé! Tyo-tó!
Se-Wis'sy-wissy, Wis'sy-wissy, Weé!

The two last-quoted verses are excerpts from poems in Dr. Garstang's delightful little volume "Songs of the Birds."

At the best such attempts cannot hope to give more than an imitation in assonance of a bird's song—sometimes they are successful and sometimes they are not. I must confess that whereas the lark's song represented above does ring true to nature, the robin's song so courageously rendered into syllables by Dr. Garstang conveys nothing to me. I can find little contact between it and the robin which is at present singing beneath my window. But it is only fair to add that Dr. Garstang embeds his syllabic verses in charming poems which, in considerable measure, do catch the spirit of

bird-song. To most bird-lovers, however, there is something a little repulsive and reminiscent of the dry, angular, faded birds of museums, in songs of the birds interpreted in this way.

3. Coming to the prose description of the songs, we find that in the hands of a master such as John Burroughs or W. H. Hudson this method is wonderfully successful. For instance, the latter's description of the song of the willow wren as "a song that was like a wonderfully bright and delicate human voice talking or laughingly saying something rather than singing" cannot be excelled. Of the lark he wrote: "The song of the lark is a continuous torrent of contrasted guttural and clear shrill sounds and trills, so rapidly emitted that the notes, so different in character, yet seem to interpenetrate or to overlap each other, and the effect on the ear is similar to that on the eye of sober or dull and brilliant colours mixed and running into one another in a confused pattern. The acutest note of all, a clear piercing sound like a cry several times repeated, is like a chance patch of most brilliant colour occurring at intervals in the pattern." Then again, of the common bunting he wrote: "The common bunting's little outburst of confused or splintered notes is when heard [by me] at the same time mentally seen as a handful of clear water thrown up and breaking into sparkling drops in the sunlight."

This maybe compared for truth and beauty with Dr. Garstang's *Tik, tik, tik, Tizzy —ketinkity—teáze!* and a recent writer who says—"if you think of it as produced by the grinding of two pebbles together till they triturate their gritty sides, then you get very near it indeed."

A couple of quotations from other writers must suffice. Mr. H. J. Massingham writes thus in "Birds of the Countryside" about the dabchick's "song": "Mr. Edmund Selous describes the liquid, inflected call of the dabchick as a 'hinny' and that's good, but too harsh. My own version is a kind of silvery yodel, wild and of the water, watery. It is like a single long spider's thread hung with raindrops, each one pure and

Photo: F. T. Newman.

When Viscountess Grey hears the Wren sing she thinks of the little tailor in Grimm's tale who told people that he had killed "seven at one blow."

bright, and is to the pond and river what the windy tremolo of the wood-wren is to the beech-grove." St. George Grove writes thus of the black-bird: "He selects a spot where he is within hearing of a comrade, and then he begins quite at leisure, (not at all in a hurry like the thrush) a regular conversation. 'And how are you? Isn't this a fine day? Let us have a nice talk,' etc., etc. He is answered in the same strain, and then replies, and so on. Nothing more thoughtful, more refined, more feeling can be conceived."

Everyone must interpret bird-song for himself, and it is natural that a song should mean very different things to different people. I can never hear a wren sing without wondering why there is no legend telling how, when each bird was being taught its song in distant primeval days, some ogre appeared as the wren was learning his little trill and so frightened him that he rushed away without learning the end of it, and has ever since been a timorous skulker in the undergrowth. On the other hand, when Viscountess Grey hears a wren she "thinks of the little tailor in Grimm's tale who told people that he had killed 'seven at one blow'; and such was his manner and general demeanour that everyone thought he meant seven giants, till it was known it had been seven flies."

These prose descriptions, while conveying comparatively little to those who do not know the song, are very helpful to those who do, in bringing to light aspects, the interest and importance of which was not before realized. A good description of a song seems to lead one into its very depths and unravel strands whose beauty passed hitherto unperceived. One cannot read a good prose description without the song becoming a more lovely and interesting thing.

Phonetic Interpretation of the Songs

4. With regard to bird-song as rendered by onomatopœic poetry, it may be wondered why I have not made a fifth class: Bird-songs as interpreted by poetry. But I prefer not to make a distinction between poetical descriptions in prose such as those we have just noticed, and descriptions in rhyme and metre. One's classification cannot be very rigid.

The essence of this type of poetry is to give the assonance of a bird's song in words which at the same time express in some measure the spirit of song and singer, thus combining the syllabic and descriptive methods. It may be noted at the outset that many birds have been given onomatopœic names—names which have been suggested by their calls. The Latin *cuculus*, French *coucou* and English cuckoo are familiar examples. The whip-poor-will of America and why-did-he-do-it bird of India (a small heron) show how widespread is the custom of naming a bird after its call. Other examples will at once occur to the reader.

What the Thrush Sings

The song of the thrush lends itself admirably to phonetic treatment, as the following quotations will show.

There—there—there—(so he sang)
Can't you see, can't you see, can't you see it?
Love is the secret, the secret!
Could you but know it, did you but know it!
Hear me, hear me, hear me!
Down in the forest I loved her!
Sweet, Sweet, Sweet!
Would you but listen,
I would love you!
All is sweet and pure and good!
Twilight and morning dew,
I love it, I love it.
Do you, do you, do you?
(S. R. CROCKETT in "The Lilac Sunbonnet.")

Worse, mocked the Thrush, Die, die!
O, could he do it? Could he do it? Nay!
Be quick, be quick. Here, here, here" (went his lay)
Take heed! take heed! then, Why? Why? why? why? why? why?
See-ee now! See-ee now! (he drawled).
Back! back! back! R-r-r-run away!
(W. ALLINGHAM in "The Lover and Birds.")

Dear, dear, dear,
Is the rocky glen;
Far away, far away, far away,
The haunts of men.
Here shall we dwell in love
With the lark and the dove,
* * * * *
With glee, with glee, with glee,
Cheer up, cheer up, cheer up, here
Nothing to harm us, then sing merrily,
Sing to the loved ones whose nest is near,
Qui, qui, qui, kweeu, quip,
Tiurru, tiurru, chipiwi.
Too-tee, too-tee, chiu-choo,
Chirri, chirri, chooce,
Quiu, qui, qui!
(W. MACGILLIVRAY.)

Such illustrations could be multiplied indefinitely. For instance, a lovely example may be found in Fay Inchfawn's "Verse Book of a Homely Woman." Note how true each of these examples is to the reiteration which is so characteristic of the thrush's song.

The wise thrush he sings each song twice over,
Lest you should think he never could recapture
The first fine careless rapture!

The Skylark's Song in Words

The song of the skylark has been dealt with under heads 2 and 3. Comparison with the following versions may be of interest.

La gentille alouette
Avec son tire-lire-à-lire,
Et tire-lire-à-lire
Tirelirant tiûre.
Vers la voute du ciel,
Puis s'envol vers ce lieu
Vive.
Et désire dire:
Adieu Dieu!
Adieu Dieu!

(CHARLES D'ORLÉANS.)

Up in the lift go we, go we
Tee-hee, tee-hee, tee-hee, tee-hee.
There's not a shoemaker in the earth
Can make a shoe to me, to me.
Why so, why so, why so?
Because my heel's as long as my toe.

(A Scottish folk-song.)

Air, air! blue air, and white!
Whither I flee, whither, O whither, O whither I flee!
(Thus the lark hurried mounting from the lea)
Hills, countries, many waters glittering bright
Whither I see, whither I see! deeper, deeper, deeper,
Whither I see, see, see!

(W. ALLINGHAM in "The Lover and Birds.")

The pretty lark climbing the welkin clear,
Cheers with a peer, "Come here, come near, my dear."
Then flitting thence, seeming his fall to rue,
"Adieu," he saith, "adieu, dear, dear, adieu."

(ANON.)

A further example is "Glycine's Song" by S. T. Coleridge.

The following selections will show how widely bird-song lends itself to phonetic treatment.

The corncrake:

I heard him near where one lay dead,
Ache, ache!
Crying among poppies red,
Ache, ache, ache, ache!
And where a solemn yew tree waves,
Wake, wake!
All night he shouts among the graves,
Wake, wake, wake, wake!

(From the "Corncrake," by J. COUSINS.)

The starling:

I've a jacket, jewelled, speckled, green-enamelled, purple-freckled,
See my silver greaves and cuisses gleam and shine, so fine.
I've invested in an outfit, not to peak and pine and pout fit,
But to suit an optimistic soul like mine, like thine.
Very few,
Like to sit with me and chuckle, rain or shine.
Too true.

* * * * *

There's no song that I can't tackle, pee-wit's weep or chicken's cackle.
I can imitate and mimic every one, what fun!
Piper, snipe or common sparrow, thrush or curlew, old or callow—
What! you say you don't believe it? See it done. (Then run)
Corlee-oo.
I can whistle just as well as any one.
Toodle-oo.

(E. A. A.)

The Woodpigeon and Robin

The woodpigeon:

O swear not you love me, for you cannot be true,
O perjured wood-pigeon! go from me—woo
Some other! Heart-broken I rue
That softness, ah me, when you cooed your false coo
Soar to your new love—the creature in blue!
Who, who would have thought it of you!
And perhaps you consider her beau—
Ootiful! O you are too cru—
Bid them come shoo-oot me, do do!
Would I had given my heart to a hoo—
Oo-ting wood-owl, cuckoo, woodcock, hoopoo.

(W. H. HUDSON.)

The robin:

"There's something, something sad
I half remember," piped a broken strain.
"Well sung, sweet robin!" Robin sung again
"Spring's opening, cheerily, cheerily, cheerily! be we glad!"
Which moved, I wist not why, me melancholy mad,
Till now, grown meek,
With wetted cheek.
Most comforting and gentle thoughts I had.

(W. ALLINGHAM in "The Lover and Birds.")

The reader who cares to follow out this line of thought will find other songs of birds interpreted phonetically in: W. Allingham's "The Lover and Birds" and "The Leprecaun," where the songs of chaffinch, blackbird, and yellow-hammer are rendered; Father Hopkins' "The

Woodlark," which he calls " the finest thing I ever wrote" ; J. Cousins' " Spring Rondel by a Starling," and "The Peewit " by G. H.

Mr. Warde Fowler once wrote : " Strange as it may seem, the song of birds may be more justly compared with the human voice when speaking than with a musical instrument or the human voice when singing." Even a better comparison is with the human voice whispering, when the gutturals become less prominent and the sibilants are emphasized. Whisper the syllables " *feet-a-feet, feetafeetit* " and a successful simulation of the swallow's twitter is obtained. Similarly, if these onomatopœic poems are read over quietly to oneself, one comes as close to the spirit and utterance of the bird as any unfeathered biped may hope to attain.

The description of a bird song is nothing more than a description ; it does not give the song, and after all it is our very impotence to produce music like the birds which gives their spontaneous utterance its charm. The voice of a bird takes us to another world, indeed to the golden gates of Heaven itself. The words of O'Shaughnessy's " Ode " might have been written to express the spirit of a bird's song.

We are the music makers,
And we are the dreamers of dreams,
Wandering by lone sea breakers,
And sitting by desolate streams.

* * * * *

O men it must ever be,
That we dwell in our dreaming and singing
A little apart from ye.

Photo : Stanley Crook.

I heard him near where one lay dead,
Ache, ache !
Crying among popoles red,
Ache, ache, ache, ache !

(*From the "Corncrake," by J. Cousins.*)

The Merlin is the smallest of our British falcons, and is most commonly found in the north of England and on Scottish moorlands. The photograph is of a male Merlin at nest among the sand-dunes.

29.—THE SMALLEST FALCON: THE MERLIN

By GEOFFREY C. S. INGRAM and CAPT. H. MORREY SALMON, M.C.

With photographs by the Authors

THE merlin is partially a migrating bird, and though fairly generally distributed throughout Great Britain, is most commonly found in the north of England and in Scotland. Here the large expanses of wild, heather-clad moors form the natural home of this the smallest of our British falcons. It occurs less commonly throughout Wales, and only occasionally farther south.

A true falcon, it is of a bold disposition, especially the female, which is rather longer and more heavily built than the male. The latter seldom exceeds ten inches in length, whereas the female may be twelve.

The bill is of a dark, bluish-horn colour with a patch of yellow bare skin at the base. The iris is dark brown, the legs and feet yellow.

In the male the crown and whole of the back, rump, and wing coverts are dark bluish grey; the tail is of the same colour, noticeably barred with black and tipped with white; the primaries are black; the chin and throat are whitish, the breast and underparts light rusty colour streaked with dark brown.

The female has the whole of her upper parts a dark bluish brown, slightly barred on the back, and more so on the tail with a lighter brown, the chin and throat are creamy white, but otherwise the underparts are brownish white, streaked with dark brown.

The flight is normally dashing and rapid, close to the ground, with a quick, rather fluttering wing-beat and few intervals of gliding.

The merlin should not be confused with any other British species, though the

female occasionally, especially when carrying prey, may bear a superficial resemblance to the kestrel, but her dark brown coloration, even at a considerable distance, is easily distinguished from the kestrel's light reddish-brown upper parts.

Their food chiefly consists of small birds, and the species which suffers most from their depredations is probably the meadow pipit, though larger birds such as blackbirds and thrushes are often captured, and occasionally even the lapwing. Young grouse, plover, etc., are seldom taken. The merlin's usual method of hunting is to chase a small bird over the open until it is exhausted, or, as in the case of a skylark, to drive it high up into the air, following every twist and turn with amazing accuracy.

Occasionally we have seen a pair of merlins following the same small bird, each in turn taking up the chase as the unfortunate victim doubled or evaded one or the other, until at last it was seized.

Merlins show a great attachment to their breeding haunts, and a nest may be found year after year within a few yards of the same spot. It is usually on the ground, and though there have been records of merlins occupying old crows' nests in trees, they are exceptional. On the moors the nesting-site is usually in fairly deep heather, and the nest itself consists of a mere hollow in the ground, with possibly a slight lining of dead heather twigs, but in the district in South Wales where we have had an opportunity of studying these fine little falcons at home, they breed on the wild and desolate sand-dunes fringing the coast, often but a stone's throw from the beach. Here they build a quite substantial nest of grasses on top of some commanding sand-dune covered with marram grass, and often it will last until the following year, in spite of the effect of rain and winter storms upon its unstable foundation of sand.

On the coast of South Wales the Merlin builds quite substantial nests of grasses on the sand-dunes.

FEMALE MERLIN FEEDING YOUNG.

The chicks wear their creamy-white down for the first few days of their life, but it is soon superseded by a coat of greyish down, which grows thicker and longer as the primary tail quills appear.

The eggs, in our experience, usually number four, occasionally five, though we believe a clutch of six has been recorded. They are laid on alternate days. A rather elongated oval in shape, they are usually very closely mottled and finely spotted with a rich purplish brown, which, as a rule, quite hides the ground colour—a creamy or buffish white. Occasionally one egg in a clutch is very lightly spotted, or has only a zone of marking round one end. When first laid a distinctly warm, reddish tinge is noticeable, but this disappears after the first few days' incubation.

The first egg may be laid during the early days of May, but more often about the second week, and sometimes later.

Both birds take turns at incubating, though the female does the greater share, and the period is about thirty days, though as incubation, as a rule, commences after the second egg is laid, the chicks may hatch out at intervals over a period of several days, consequently there is often considerable variation in size between the young ones.

Young Merlin of twenty-eight to thirty-one days old, near to the nest, in which the brood remains for between three and four weeks.

When newly hatched they are covered with a short creamy-white down, but in a few days a new coat of greyish down commences to appear, until in about ten days they are covered with a coat of longer and thicker grey down, and the primary and tail quills begin to grow.

They remain in the nest for between three and four weeks, and though they may begin to wander round at this period, they usually return to it to be fed.

In their fourth week they shed the down tufts which adhere to the tips of their newly acquired plumage and take short flights. When about a month old they can fly quite strongly, though they still remain together and their parents bring the prey, leaving them to pluck and dismember it themselves.

From the time the young are hatched the male bird seldom, if ever, visits the nest; the female alone attends to the young ones, while he does the greater part of the hunting and foraging. Often they have two or three well-known prominent points, a large stone or a protruding mound, to which they take the prey to pluck it, and from one of these the male calls his mate to fetch the kill. Sometimes a bird,

ready plucked, is left on each of these points for the female to fetch when she requires it.

When the nest is approached one or other of the birds gives the alarm and both fly round in a very agitated way, uttering a high pitched chattering *kik-ik-ik-ik* . . . while often, especially after the young are a couple of weeks old, they will swoop at any intruder, screaming continuously. They are very bold, too, in attacking their natural enemies, and we have several times watched them drive off from the vicinity of their nest and young such large birds as the raven and peregrine falcon.

How the Merlins were Photographed

We have for many years watched the merlins on the stretch of coast-line previously referred to, but on two occasions only has it been possible to make any attempt at obtaining photographs of the adult birds at the nest, owing to their habit of selecting the very top of an isolated dune, with no other sand-hill near enough or high enough to give a view of the nest.

However, we were fortunate in finding a nest in 1920 and another in 1922, both of which could be overlooked from a neighbouring sand-hill. The latter site was a long sand ridge running N.E.—S.W., some fifty feet in height above sea-level, with its top broken up into a number of small sand-hills from about ten to fifteen feet high.

The nest was built on one of these, and behind and overlooking it was another, which was practically the highest point of the ridge. Upon this our hide was constructed and covered with marram grass tufts, so that at a little distance it was indistinguishable from any grass-covered dune.

It was not a good observation post, for the small size of the top of the dune made it extremely uncomfortable, and, as the weather during the whole time was very stormy and wet, it was both draughty and damp.

The first egg of the four which the nest contained had been laid on May 20th, but the hide was not erected until the latter end of June when the young had hatched out, and we did not attempt to take any photographs until July 2nd when the young ones were about seven to ten days old. It was a wretched day, very windy with frequent violent rainstorms, but taking advantage of a fine spell one of us entered the hide, and his companion had hardly been gone a few minutes before the female merlin returned.

She was rather uneasy at first, but gained confidence fairly quickly, and walking from the edge of the nest, shuffled over the young ones, brooding with her breast not quite covering them. They could be seen all the while, and she was really more standing over them to shelter them from the wind than brooding.

After about ten minutes she vanished suddenly, and then almost immediately returned carrying a small bird in her talons. It was already defeathered and headless, and she promptly proceeded to break it up and feed the young, the largest of which received the lion's share, while the youngest and smallest hardly got more than one mouthful.

A blinding rainstorm swept up from the sea in the middle of the meal, and she left the prey on the side of the nest and brooded the young, head to the wind, with lowered wings and breast, her tail elevated.

The youngsters seemed to be securely tucked away between her legs and under her tail, and she lowered her head until her beak touched the sand, while the rain, driven by the raging wind, beat down upon her and drenched her feathers.

This storm did not last long, but she remained brooding, though she altered her position when it had passed and sat with head well up and tail down, still completely covering the young.

How the Youngsters Were Fed

A second and worse storm broke, and again she crouched with lowered head facing the gale, but as soon as it had passed she shook herself, got up and started to tear up the remains of the last meal, looking very bedraggled after her soaking.

Five minutes were sufficient to clear up the remains, and she then left, but was back again very quickly carrying another small plucked bird. This was soon torn up and disposed of, the largest youngster again getting the biggest share, while she herself ate one or two pieces and finally

Merlin feeding her brood of fourteen to seventeen days old. The female attends strictly to domestic duties, while the male does the major part of the foraging.

swallowed the legs; after which she brooded for an hour before leaving to fetch some more supplies, when she again fed the young and resumed brooding.

A little later the male called to her from some distance; she left the nest and returned almost immediately, carrying a pipit ready plucked, which she tore up and gave to the young ones, leaving, however, several bones and pieces on the side of the nest.

It was evident that the male had been doing the hunting while she was brooding, and all that she was called upon to do was to fetch the prey which he brought, usually to a dune some three hundred yards from the nest, where he plucked it before handing it over to her.

We next visited this family a week later; the young had grown considerably, being from fourteen to seventeen days old, and their tail and wing quills were quite obvious.

It was again a stormy day, and heavy rain showers were constantly blowing up from the sea. The female was absent for the first hour and a half of observation, and during this time the youngsters remained bunched up together, cheeping now and again, and occasionally calling querulously. When she returned she carried a small bird in her talons and alighted on the grass at the back of the nest.

Here she transferred the bird to her beak, and, walking down to the young ones, commenced to tear it up and feed them. This meal lasted five minutes and she flew off, returning in a quarter of an hour with another bird, which was disposed of as quickly as the first had been.

Leaving again immediately, she was back in fifteen minutes with another small bird for the third time. On this occasion the meal occupied ten minutes, as the young were not quite so eager, and towards the end she singled out the baby and fed it very carefully on small pieces. Large pieces given to the other youngsters occasioned some difficulty at times. She herself ate a good deal—finishing up the bones.

It appeared as though the brooding period had passed, as she made no attempt now to brood or shelter the young, however bad the weather.

On July 16th, as we neared the nest, the adult birds were quickly in evidence, uttering their alarm as usual, but only the

baby was to be seen on the nest, all the other youngsters being scattered around some five or six yards away. We restored them to the nest before entering the hide, but they soon got restless and eventually wandered off the nest dune out of sight. They evidently found some shelter from the wind under the lee of the dune, and though one or two appeared on top at intervals, they stayed there most of the time.

When the female returned she uttered a long-drawn call as she came, and carried a partially plucked small bird. The young were quickly round her on the nest, which was now quite flattened out, and after tearing off a few bits which she gave to them, she stood on one side and let them dispose of the remains themselves. Food seemed to be scarce, as the young were fed only three times in the course of three hours, and after each meal they wandered out of sight.

The female was hunting herself to-day, and from the hide she could be watched flying off inland for half a mile or more to some hunting ground.

Our last visit was on July 22nd. The nest was empty and looked as though it had not been used as a dining-room for some time. The top of the hide and the neighbouring dunes were liberally sprinkled with grey down, pointing to their having been used as preening stands by the young. These we eventually found after a search on the ridge nearly a hundred yards from the nest. Three could fly quite strongly and took wing as we approached; the youngest remained until we were quite close, when he flew off strongly but a bit heavily, and landed with rather a bump on the slope at the opposite side of the valley.

They left behind them a juvenile linnet, intact and unplucked, and a partially plucked meadow pipit, as well as various other remains, which included portions of a wheatear and a greenfinch.

By careful stalking, a portrait of one of the three elder members of the family sitting on the extreme end of the ridge was secured, and this was the last record we were able to make of this interesting family, though it was a matter of great satisfaction to us to see four such fine little falcons successfully reared.

Young Merlins of twenty one to twenty-four days old standing by while the mother rends the prey.

Photo: Henry Willford.

The little olive-green eggs of the Nightingale are inconspicuous in the nest, which is built of dead oak leaves and lined neatly with fine fibre or hair.

30.—OUR KING OF SONG

By HENRY WILLFORD

THE nightingale! What memories the very word arouses! Memories flash into mind, not only of all that has been said in prose and verse about our king of song-birds, but of dusky nights in early summer, when from the coppice below the little bird sat calling—trilling into the darkness hour after hour his long, plaintive, soul-stirring appeal. On and on he sang, regardless of our approach, and again during the long night, whenever one awoke, through the open window came those same sweet, haunting notes. Just for a month or two each year are the nights alive and throbbing with his music; then after mating and nesting and rearing his family, in August he goes once more to the south, whence he came.

It is in April that the male nightingale comes to us, to the Isle of Wight and the coast early in the month, though farther inland it is usually not until the warmer nights of May that his voice is heard. Before the hens arrive he sings for practice—for joy perhaps in the spring, or to outrival other male birds and so win the fairest mate among the later comers. With practice comes the full tide of his love-song—all day, it seems, as well as all night, untiringly he will sing, one of the least often seen, yet the most renowned of all our birds.

So far as I know it is a fact quite unexplained that while he comes year after year to a part of England—to the Isle of Wight, Hants, Berks, Surrey and other south-eastern counties—yet in Devon, Cornwall, Wales and the North he is wholly unknown. Indeed, to miss the nightingale in spring is a loss to which the sojourner in the West becomes never wholly reconciled. There is some evidence, however, that his range is extending towards the south-west.

In his chosen localities, however, though his presence is so loudly proclaimed, the

nightingale is not easily seen. His small size and modest colouring—brown, in both sexes, with russet tail-feathers and lightish underparts—render him inconspicuous in the thick tangle of undergrowth that he chooses for his nest. Both bird and nest are a striking instance of protective coloration, for they resemble their surroundings so completely as to defeat the eye even of an expert. The little olive-green eggs are themselves inconspicuous, and the nest is built of dead leaves, oak for choice, lined neatly with fine fibre or hair. Usually it is on the ground, but I have found it at times raised some twelve inches in the fork of a low-spreading hawthorn. During twenty odd years I have found only seven nests with eggs, though perhaps a score or more containing young birds.

That is the easiest time to find the nest. While she is brooding—a period of about fourteen days—the hen will almost let one tread on her before she will move; but after the young are hatched one has only to wait long enough, and sooner or later the parents are sure to reveal it. With beaks full of young larvæ they come, cautiously and suspiciously, flying from branch to branch, and after giving a harsh call, as if warning the children to be ready, eventually alight on the edge of the nest, where the hungry, clamouring babes await them.

The food they bring consists almost entirely of green caterpillars. But they are fond of maggots; although it sounds unromantic, a piece of fly-blown liver put near their haunts is a great encouragement to nightingales. After watching the young ones swallow their meal, sometimes the male will break into song, but after a few bars he stops suddenly, as if remembering that he is now a married man with the cares of a family on his shoulders, and it might be better to stick to work instead of singing so much about it. So away he goes with his wife on the wing in search of further provender. The young nightingales are certainly somewhat pampered children, for they stay on in the nest longer than the young of most birds.

Photo: Henry Willford.

The small size and modest colouring of the Nightingale render it inconspicuous on the nest, which is built in the thick tangle of undergrowth.

Perhaps this is because there is only one brood in the season, and there is, therefore, no need to send them into the world too soon.

Nesting so low on the ground the nightingale family runs considerable risk from ground-hunting vermin. I well remember how thrilled I was once when photographing a pair in the New Forest. The hen was brooding at the time, and I was concealed

Photo: Henry Willford.

Caution marks all the movements of the Nightingale when feeding the young. With beak full of larvæ, the hen flies suspiciously from branch to branch in her progress to the nest, where her clamouring babes await the meal.

in my "hide," complacently smoking, when I heard a rustle among the leaves. For the moment I thought it was a blackbird, but on putting my eye to an observation hole I was astonished to see a large stoat within two feet of the nest. The hen crouched, staring at the enemy as if paralysed. The stoat, with head well up as if casting for a scent, waited also, silent and motionless—while I, for the moment, was spellbound. Then, all at once, came a rush of wings, and the harsh, warning note of the male nightingale. By short flights backwards and forwards he diverted the stoat's attention; fluttering, teasing and calling as if to say "*You* can't catch me," little by little he drew the aggressor away. Undoubtedly the gallant little bird saved the situation, for as they vanished into the deep greenery all sounds of disturbance ceased, and the hen brooded on in safety.

In photographing the nightingale, one of the chief difficulties lies in the poor light that always prevails amongst the thick undergrowth of his nesting site. Added to that is the difficulty of following his quick, jerky movements. On the other hand, he is of a confiding nature, and after a little while will take no notice of the camera. At one time, indeed, I found that a pair I had under observation in the New Forest became so tame that I was able to discard the usual type of "hide" and could sit on a stool behind the camera, with only a dark cloth over my head. In this way I found it much easier to deal with any particularly interesting incident or pose.

Though for his home building the nightin-

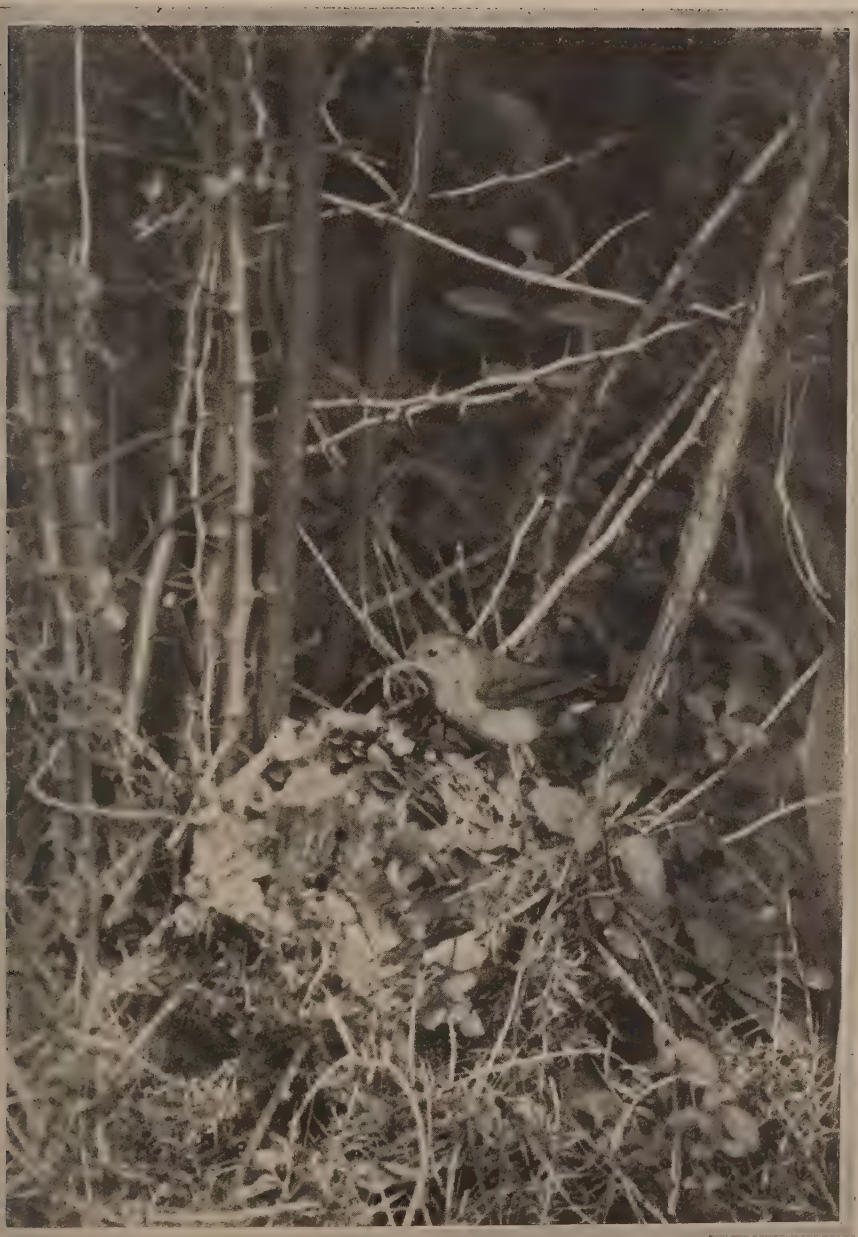


Photo: Henry Willford.

NIGHTINGALE JUST ARRIVED WITH FOOD AT THE NEST.

Green caterpillars are a favourite diet of the brood, although they are fond of maggots. The male sometimes will break into song after the young have swallowed the meal.

gale chooses so retired a nook, yet he will sing without embarrassment close by the roadside. A few years ago, when in the course of work I drove home each evening in the dark, night after night, as I passed a clump of rough bushes I was impelled to pull up and listen to the marvellous liquid clearness of the song that rang out into the stillness. I have heard the Indian shama and many another splendid songster, but in all the world none that I have heard can compare for beauty and passionate expression with this little brown bird of our homeland woods.

Photo : G. C. S. Ingram, M.B.O.U.

Young Nightingale just fledged. The little brown bird of our homeland woods is certainly a somewhat pampered child, for it stays on in the nest longer than the young of most birds.

Like so many other insectivorous birds, nightingales fall easy victims to the wiles of the trapper. Years ago, during a visit to the Balearic Isles in the company of a friend who was interested in the ringing of migrant birds with a view to proving more definitely the extent and ways of their migrations, we experimented with a number of small spring net traps.

In the early spring these islands abound in all manner of bird-life, and of the warblers the nightingale is perhaps one of the most common. Some of our spring traps were placed on the ground near a small stream that ran through one of the many delightful orchards. After carefully setting and baiting each trap with a wriggling mealworm, we had, usually, only to wait a short while before one was sprung. The captive was then removed unhurt, and a tiny aluminium conference ring gently slipped on to the leg before releasing it. Each ring was, of course, numbered, and full details as to time and place of ringing duly noted. By this means of marking birds many interesting facts connected with their migration have come to light.

We must always regret seeing such a species as the fragile nightingale made captive, if only from sentiment, but I believe it is on record that they have actually bred and reared young in a comparatively small cage. There are undoubtedly many aviculturists, as distinct from field naturalists, who manage to keep in superb condition even the most delicate birds by understanding their needs. One has only to visit the wonderful exhibitions of British and foreign birds held annually at the Horticultural Hall and elsewhere, to appreciate both the skill of the keepers and beauty of the exhibits. In spite of this, however, most of us will prefer to make acquaintance with the king of song in his own haunts of leafy woodlands, rather than see him captive, even in the most luxurious of prisons.

But when I stood beneath the fresh green tree

. . . . . .

And saw around me the wide field revive
With fruits and fertile promise, and the Spring
Came forth her work of gladness to contrive
With all her reckless birds upon the wing,
I turned from all she brought to those she could not bring.

BYRON.

MERLIN BROODING HER YOUNG

Photograph by G. C. S. Ingram

MERLIN AND HER FAMILY OF NEWLY-HATCHED CHICKS

Photograph by J. D. Rattar

EXPECTANCY

Young Merlins about twenty-one to twenty-four days old

Photograph by G. C. S. Ingram

WHO GOES THERE ?

Young Merlins about a month old

Photograph by Stanley Crook

The Death's-head Hawk-moth resting on an ivy twig. It is a creature of nocturnal habit, and the largest of British moths. The peculiar skull-like marking, which gives it its name, is borne on the back of the thorax.
(*Natural size.*)

17.—A WEIRD INSECT: THE DEATH'S-HEAD HAWK-MOTH

By JOHN J. WARD, F.E.S.

Illustrated with photographs by the Author

AMONGST the most curious of creatures of nocturnal habits is the death's-head hawk-moth (*Acherontia atropos*). On the back of its thorax it bears the weird, skull-like marking which gave origin both to its popular and its scientific names. That feature, together with its great size, has been quite sufficient to create an atmosphere of mystery around this insect, and from the earliest times it has been associated with much superstition. Its sudden appearance was generally regarded as an ill-omen, either personal, to one's household, or, not infrequently, to the developing crops of the "unfortunate" individual who happened to discover it.

Such superstitions have been largely added to by a still more strange characteristic possessed by this moth. When captured, it will often make a plaintive, whining noise, which has sometimes been likened by scared hearers to that of a child in pain ; but which would perhaps be best described as similar to that of a terrified mouse.

Since the human mind was always more prone to accept irrational statements regarding creatures whose habits were unknown, rather than to ask for proof of such assertions, it is not difficult to imagine how superstition has gradually grown around this insect, which is but rarely seen, and, when discovered, presents a weird symbol of death, and utters a mournful note when touched—a characteristic amongst moths which seems to be peculiar to this one.

Its scientific names are even more significant as regards superstition. *Acheron*, a Latin word derived from the Greek, refers in classical mythology to the River of Woe in Hades ; while *Atropos*, also of Greek origin, was the name of one of the three Parcæ, or Fates, whose duty it was to cut the thread of life.

The moth has an extensive distribution throughout Europe and many other foreign lands, and has been called by such awesome names as the " wandering death-bird " and the " death's-head phantom." The dust from its wings is said to produce blindness, should it fall into the eyes when a moth at night enters a lighted room—for artificial light has a great attraction for it.

At various times specimens have been captured in most parts of the British Isles. Probably, though, the greater number of these are of alien birth, as the insect is a migrant, and captures have been made in the open sea at long distances from land. A seaman officer one day showed me a specimen he had captured eighty miles from the shore. While on the bridge he saw something alight upon the deck ; other eyes than his also saw it, for it was instantly swooped down upon by the ship's cat. The officer secured the cat, and discovered in its mouth the death's-head hawk-moth.

Just prior to flight, the Death's-head Hawk-moth will crawl to a suitable spot and set its wings vibrating at an enormous speed, as though it were "testing its engine" before rising into space.

Probably some of the moths taken in late summer and autumn are the offspring of migratory specimens which arrive from abroad early in the year and deposit their eggs on the young foliage of the potato plants.

It need scarcely be stated that, in spite of its uncanny characteristics, the moth is quite harmless. Its greatest crime seems to be that of robbing beehives of their honey; probably in the days when more of the old straw-skep hives were used its opportunities were greater for such visits than with the modern hives of to-day; for many old country people regard this as a standing grievance against it, while its visits seem almost unknown amongst modern bee-keepers.

The larva of the Death's-head Hawk-moth seen in a resting attitude. When full-grown it sometimes attains a length of nearly five inches and the thickness of a man's finger.

Most of the hawk-moths have a coiled sucking proboscis of a considerable length; it may be as long, or sometimes nearly twice as long, as their bodies, but that of the death's-head moth is very short. Moths with long tongues poise themselves on rapidly-vibrating wings before flowers with tubular corollas—e.g. the honeysuckle—and, without alighting, probe the depths of the floral tubes for the nectar they contain by means of their uncoiled proboscis. The death's-head moth, although equally capable in flight, is debarred from this method of feeding on account of its short tongue; hence its habit of raiding the hives in search of honey. It will also feed on the sweet juices of over-ripe and broken fruit; but flowers seem to offer no attraction for it.

Throughout the day it is extremely sluggish, and rests in the attitude shown in the first photograph; but as evening approaches it becomes active, and, just prior to flight, will often exercise itself by crawling a short distance amongst the branches, and, selecting a suitable spot, will set its wings vibrating at an enormous speed, but without taking flight. This action is familiar in most moths with heavy bodies, and is apparently a method of "testing their engines" before rising into space.

Such testing of the wings is necessary on account of their speed of flight. I have frequently seen hawk-moths fly round the globe of an electric arc-light at such a rate that only occasionally were they distinctly visible; it was far easier to follow the large black shadows they cast on the ground than the whirling moths themselves.

The caterpillar is even more striking in appearance than the moth. Nearly

five inches in length and as thick as a man's finger, it is a variable yellowish-green in colour, with seven oblique, violet blue bands edged with yellow on each side of its body and meeting along its back; and it is further enlivened with blue spots and a yellow tuberculated tail appendage. Its coloration is, however, subject to variation; sometimes the yellowish-green ground colour is replaced by soft brown shades, and the blue spots become white.

Larva of the Death's-head Hawk-moth feeding on potato bines. In colour it is a variable yellowish-green, with seven oblique, violet-blue bands edged with yellow on each side of the body and meeting along its back. Blue spots also appear, and it has a yellow tuberculated tail appendage.

When resting it assumes the attitude shown in the illustration on p. 635, and if touched will rapidly swing its head from side to side several times, sometimes making a peculiar snapping noise. Its vivid colours and active movements are generally sufficient to dissuade those who meet with it for the first time from touching it. I once had a specimen brought to me by a man who warned me to open the box carefully, as he felt sure he had got a poisonous reptile. When I told him that reptiles should not have more than two pairs of legs, and the "animal" he had brought appeared to have eight pairs, he became a little more reassured. He was extremely surprised to learn that what he had captured was nothing more than a harmless caterpillar. Such mistakes are quite forgivable, however, as the brilliant colours certainly give one the impression of a tropical animal, rather than a British caterpillar.

Although so large a larva, it feeds up rapidly, requiring little more than four weeks to become full-grown; indeed, the development from the egg to the moth stage may be completed in about eight weeks. It is more often found on the potato bines, but will also feed on other nearly related plants such as the woody nightshade and the familiar shrub known as the "tea-plant"; and even the deadly nightshade (*Atropa belladonna*)—whose generic name is derived from the same source as that of the specific name of the moth. It has also been found feeding on the jasmine and the snowberry.

When full-fed it burrows into the soil for several inches, forming there a chamber, and then moulting its skin and changing into a glossy, purplish-brown chrysalis. The most astonishing thing regarding the chrysalis is its uncanny power of squeaking when disturbed, especially just before the emergence of the moth.

Dorsal surface of pupa of the Death's-head Hawk-moth in its underground chamber.

In the case of pupæ turned up by potato diggers in autumn, it is unwise to attempt to keep these over the winter, for although the chrysalides of many of our common hawk-moths will successfully produce moths the following spring, yet those of the death's-head seem invariably to dry and perish. It is far better to force the emergence of the moth by keeping the chrysalis in moist moss in a greenhouse or a warm room.

This remarkable insect can, therefore, make audible sounds during three stages of its development—the caterpillar, the chrysalis, and the final moth stage. It should be noted, however, that some specimens of both the larvæ and the pupæ do not appear to make any sound whatever, and this has led to many animated discussions amongst entomologists as to whether the caterpillars and the chrysalides do really make any sounds. Sometimes a chrysalis will remain quite mute until just before the emergence of the moth, and then suddenly become noisy. I am inclined to think that in all cases when sounds are produced by the chrysalis, the moth

Ventral surface of pupa of the Death's-head Hawk-moth.

has matured, and is almost ready to emerge; probably temperature, or other external conditions, may restrain it from emerging even for several days.

Various experiments have been made to show how the sound is produced. In the case of the pupa, it has been suggested that it is owing to elongation and contraction, the ringed segments causing the sound when they are tightened together; but if it can be proved that the sounds are, as I have suggested, made only when the moth is matured, it would appear that it is the moth itself which makes the noise while still within the chrysalis skin.

Regarding the moth, there is some evidence to show that the sound is produced by the tubes of the proboscis, either by air being forced through them, or by their rubbing against some parts of the head; but there is far too much diversity of opinion to arrive at any definite conclusion, as it is always a difficult matter to decide how insects produce sounds.

It is said that the moth uses its squeak to soothe the bees when it enters a hive; but probably that suggestion is more imaginative than real. Nevertheless, it is somewhat surprising that so large an insect can enter a hive and come out again uninjured. The naturalist, M. Huber, has shown that a death's-head moth introduced into a nest of humble bees was immediately attacked and stung to death; yet the stinging powers of the humble bee are much less formidable than those of the honey bee.

A "set" specimen of the Death's-head Hawk-moth, showing its large expanse of wings, and the lower pair of golden-yellow ground colour with blackish stripes. Note also the short proboscis, composed of a pair of tubes. (*Natural size.*)

It is, I think, probable that there is some reciprocal service rendered by the moth for the honey it is allowed to take; as most species of wild bees and wasps have certain privileged guests in their nests which confer some kind of benefit to their hosts. It is perhaps not too much to suggest, therefore, that such a commensalism may exist between the honey bee and the death's-head moth, although the insect is so rarely met with in this country that it is difficult to acquire scientific evidence on this point. Any casual discovery of the moth in a hive should always be carefully recorded with all possible details of the moth's doings. The writer would always be glad to be informed of such records through the Editor of this publication.

Strange Facts of Fish Life

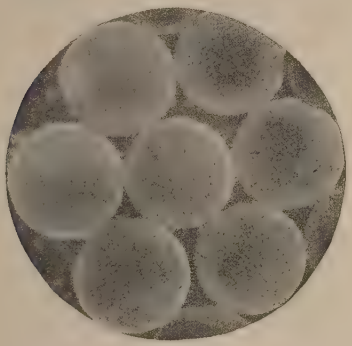
6.—HOW THE PLAICE BECOMES FLAT

By F. MARTIN DUNCAN, F.R.M.S., F.R.P.S., F.Z.S.

With photographs by the Author

"A Plaice upon a marble slab,
A simple Plaice it was to him,
And it was nothing more!"

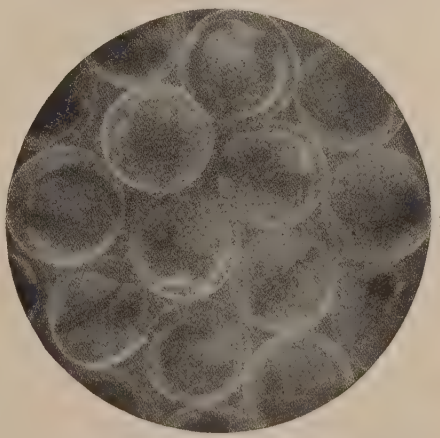
THAT, I am afraid, sums up the point of view of many people concerning one of our most valuable and popular food fishes. Probably if the plaice were a more costly fish or, like the lordly salmon, only on sale at certain seasons of the year, folk would be keener to know more about him. But there he is, good honest fish, always to be seen on the fishmonger's marble slab from New Year's Day to New Year's Eve. Yet the plaice is a fish of parts, and quite if not, indeed, more interesting than the salmon. True, he does not ascend and descend rivers, but he makes surprisingly long journeys in the sea, and has a most remarkable and romantic childhood; for not always is he a flat fish, pigmented on one side, and of purest white on the other. When the baby plaice hatches out from the buoyant egg which his mother spawned in the shallow seas, he does not in the least resemble his parents, and, indeed, quite a lot of careful and patient investigation had to be carried out before it could be definitely ascertained that this queer little baby fish was really an infant plaice.



1. Group of eggs of the Plaice. The dark masses in the centre are the merest suggestion of the larvæ.

On emerging from the egg, the baby plaice is a tiny, transparent, round-bodied little creature, perfectly symmetrical in form, and has one eye on each side of its head, just like an ordinary cod or haddock; and like those round-bodied fish, it swims in the same vertical position. But the baby plaice soon takes to living on the floor of the sea, where it lies down on its left side. Resting in this position, the left eye would, of course, be of little or no use to see with, and it is at this period in the life-history of the plaice that the strange transformation from a typically symmetrical round-bodied fish, to the flattened, unsymmetrical form takes place.

Gradually, as the little fish grows and rests

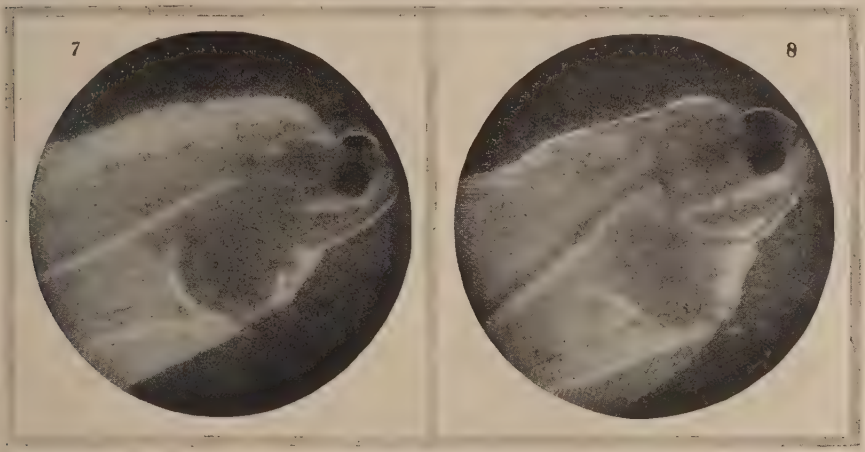


2. A stage further; the eggs are about to hatch. Note the larva showing through these buoyant spheres.

on the floor of the sea, its roundness of form disappears, and the body becomes flattened out until it finally assumes the familiar shape of the adult plaice. Nor is this all, for while the body is changing in shape and becoming flattened out, the shape of the head is also altering, for a twisting is going on in the region of the eyes and nose, giving to the mouth that curious lop-sided appearance which we see in the adult fish; while the left eye at the same time gradually shifts its position, and moves round to the upper or right side of the head. This strange shifting of the eye takes place in the young of all flat fish; in some species the eye travels round, right over the top of the head, while in others, where the top or dorsal fin extends to the snout, the eye from the underside passes through the fleshy part of the fin—not, as was first thought, through the bones of the head.

3. Young larval Plaice just hatched. The yolk-sac is seen full size. 4. Four to five days later the yolk-sac of the young larval Plaice is seen to be reduced, in proportion to the fish's growth. 5. Larval Plaice, a few weeks old, with the yolk-sac completely absorbed, and the mouth fully formed. 6. A little later, and more advanced stage, showing a marked flattening of the body.

Now the great flat fish family (*Pleuronectidæ*), to which our friend the plaice belongs, are all fishes that are remarkable for their habit of lying on one side, with very rare individual exceptions, and in having both



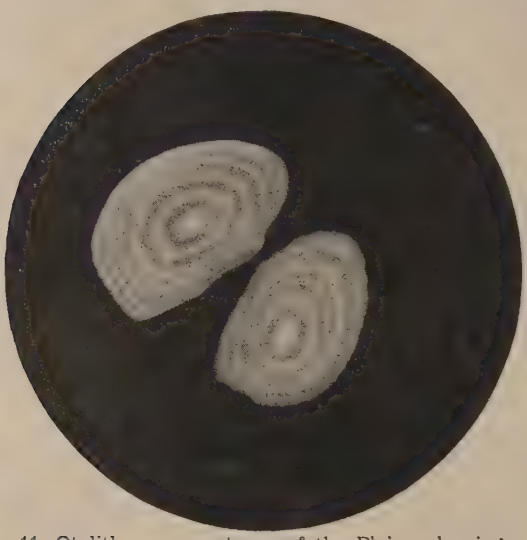
7. The left eye of the young Plaice beginning to shift its position towards the upper or right side of the head. 8. Rotation of the left eye further advanced, with one-sided pigmentation in progress.

eyes situated upon that side of the head which is uppermost. While some members of the family, when resting on the floor of the sea, habitually lie on the right side of the body, as, for example, the brill, turbot, megrim, and scald-fish, others, such as the soles, dabs, flounders, and plaice, rest on the left side. Therefore, when we look at a plaice on the fishmonger's slab, the dark, pigmented surface of the fish presented to our view is not the back of the fish, but is the right side of its body ; while the white, unpigmented surface is the left side of the fish. The loss of colour is due to the left side always being turned away from the light, for it has been experimentally proved that if a flat-fish, such as a plaice, be kept in a glass-bottomed tank so arranged

9. Rotation of the left eye of the young Plaice nearly completed; the mouth is assuming the adult position, and pigmentation is increasing. 10. Head of a young Plaice, about two or three months old, at completion of metamorphosis.

that reflected daylight is cast upward through the floor, the normal white side of the fish will eventually develop pigment spots. Occasionally adult flat fish are caught in which the eye has not migrated, and these abnormal fish frequently show pigmentation on both sides of the body, as is shown in the photographs of an adult turbot on p. 643.

A series of experiments with marked plaice, carried out by Professor Garstang in the North Sea some years ago, revealed the fact that the adult plaice is by no means a sluggish stay-at-home creature, such as one might be apt to suspect from his shape and peculiar habit of resting on one side of his flat body. Thus a marked plaice liberated on the Lemon Ground in the latitude of Lincolnshire was recaptured three months later by a Hastings trawler off Winchelsea, the fish having travelled in that time a distance of not less than 175 miles; while another marked plaice, liberated off Mablethorpe on the Lincolnshire coast, elected to journey northward, and was captured eight months later in St. Andrews Bay, Scotland, having covered a distance of 210 miles.



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11. Otoliths, or ear-stones of the Plaice, showing annual rings of growth.

I suppose that to most people the idea of marking a live fish and throwing it back into the sea, with the hope that some day it might be recaptured, must seem a curiously optimistic performance, yet not only were the two plaice just mentioned recaptured, but out of 855 so marked and liberated in this way, no fewer than 21 per cent. were recaptured within twelve months of their being set free. In a similar experiment carried out on the Dogger Bank, no fewer than 40 per cent. of the marked plaice were recaptured in less than twelve months. This will give some idea of the intensity of the fishing carried on in pre-war days by our trawlers on the Dogger Bank and in the north part of the English Channel.

It is interesting to try to find out the age of a fish. Not how long it has been out of the sea—the nose is the best judge in that case—but its age at its last birthday. Every fish carries a register of its years of life about with it, either on its body or in its head, or in both places. Not a detailed certificate which gives the day, month, year, and place of birth, but nevertheless a register from which we can make a pretty accurate calculation of its age. For example, if we carefully open the head of a plaice, we shall find therein two small oval, flat, stony bodies called the ear-stones or otoliths. If we cleanse these, and after placing them in a watch-glass filled with water, stand the watch-glass on a black card, we shall find on examining the ear-stones through a pocket magnifying glass, that they are not of the same density all the way through, but that they are made up of rings of alternate semi-transparent and opaque substance. Now the semi-transparent rings are formed during autumn and winter, when food is not so plentiful and growth is slower, while the dense opaque rings are formed during spring and summer, when food is abundant and more active growth takes place. Therefore, by taking one transparent and one opaque ring as representing a year's growth, we can arrive at the age of the fish.

The other birth-register is written on the scales with which a fish's body is clothed. Looking, for instance, at the cleaned scale of a plaice or a haddock under the microscope, we shall find that it is at once both beautiful

12. Right side of an adult Turbot in which the eye had not migrated. The pigmentation is shown on both sides of the body.

13. Left side of the same fish, showing the eye and pigmentation similar to that of the other side.

and complicated, for it appears to bear upon its surface a regular meshwork of wavy lines. Now a more careful scrutiny will show us that this meshwork is not quite the same all over the scale, but is composed of alternating bands of open and closely packed form. Here, as in the ear-stones, we have the record of seasonal growth, the narrow, close-packed mesh formed during autumn and winter, the open meshwork formed during spring and summer, so that again, by counting up these rings of growth, we can determine the approximate age of the fish and, if we are looking at the scale of the salmon, how many times he has been down to the sea.

14. An adult Plaice displaying the pigmentation on the right side of the body. This must not be taken to represent the back of the fish, but only the side which has retained its colour through being continuously turned to the light.

The plaice attains its largest size on the fishing grounds off Iceland, and trawlers on their return from these northern trips land at Grimsby fish measuring 28 to as much as 34 inches in length, dark-skinned giants of the plaice tribe. Off the east coast of Scotland they attain to 26 inches in length, occasionally to 28 inches, while in the west, on the fishing grounds between Exmouth and Plymouth, the plaice average between 18 and 20 inches in length. In fact, the plaice is essentially a northern fish at his best, growing smaller towards the warmer regions of the south, his geographical range being from the Bay of Biscay to the shores of Iceland.

The mouth of the plaice is well furnished with broad, flat teeth, and, in addition, he has crushing teeth in his throat. These throat teeth are rounded, strong and blunt, and are used for crushing the shells of the bivalve molluscs on which the plaice chiefly feeds. All kinds of sea worms are also eagerly devoured, even the sea mouse-worm, despite its fringes of stout, sharp bristles or chætæ.

Spawning takes place during the first three months of the year, from January to the beginning of April, and immense numbers of eggs are discharged into the sea. The eggs are buoyant, and are ranked among the largest floating eggs of fishes known, being a little less than one-twelfth of an inch in diameter. A female plaice 17 inches long frequently produces 150,000 to 200,000 eggs during the spawning period, while a 22-inch plaice will produce 450,000 to 500,000 eggs. The eggs take from ten to thirty days or longer to hatch, the period depending on the temperature of the sea at the time of spawning. Of course, only a small proportion of the eggs hatch, and the mortality among the resulting young is very great, so that out of the millions of eggs and young produced annually, but a small percentage attain to mature fish.

The favourite spawning ground of the plaice is at depths from 10 to 40 fathoms, where the floor of the sea is composed of sand and shells. The young fish abound in shallow water near the shore in the summer months.

Photo: J. T. Newman.

The House-martin always makes sure of a roof to its nest. If it does not find one ready made, it will make a roof of mud, leaving an entrance hole at the side.

VIII.—The Swallow's Nest

"I *KNEW* it was going to rain!" said Popsi mournfully, looking out of the window, "'cos the swallows were just *scooping* about the fields yesterday. I do wonder how they know!"

"Don't suppose they do know!" said Topsy from the table where she was busy drawing. "It's the insects that know. When there is rain coming they crowd close to the ground so that they can pop into shelter at the first drop. Then when it's fine again they go up and up and up, ever so far out of sight, and the swifts and swallows go after them."

"The swallows are all at home now," said Popsi, leaning out of the window and looking up at the eaves. "I can count ten—twelve—fourteen—fifteen nests just above the window!"

Topsy dropped her pencil and came over to look.

"Silly Popsi!" she said. "Those aren't swallows, they are house-martins."

"Well, they are just *like* swallows!" said Popsi.

"No, they are not!" said Topsy, who had all the elder sister's love of instructing. "They are smaller than swallows, and they have white breasts, and their tails aren't so forked—and I don't *think* that swallows make nests like those with a roof and a hole at the side."

Just then Boodles was seen running across the farmyard through the rain.

"Popsi!" he cried as soon as he was under the window, "do come over to the barn—there's such a squealing and chirping going on! I'm sure there's a nest up on one of the beams."

"Oooh! Hurray!" cried Popsi. "We'll come—come on, Topsy!"

The barn was a favourite haunt of the children on wet days. It was so big and dark and mysterious that they seemed never to finish exploring it. In the winter sometimes it was stacked with hay and straw and they could get up to the roof quite easily. But now it was nearly empty, and the great bare, cobwebby walls were rather daunting.

"I don't know *how* we'll get up!" said Boodles, pointing to the corner whence the chirping could be plainly heard.

"Well," said Popsi, who was a great climber, "I think if we got up here by the old cider-press, and crawled along that beam, we might get to the corner. Let's try!"

Then leading the way, with Boodles second, and Topsy bringing up the rear, they made their way cautiously along the beam.

"It *is* a nest!" said Popsi as she sidled along close under the roof. "I can see into it now. There are four dinkie little birds in it—I wonder what they are!"

"Why, they are swallows!" said Topsy as she, too, crept close. "I told you swallows did not build nests with roofs like martins!"

"How do you know they aren't swifts?" began Popsi. But as she spoke a ray of sunlight shot in through an opening in the wall, and there, with a long blue cloak covering her rose-petal gown—stood their new friend, Summer.

"So you have found the baby swallows, have you?" said she. "I wondered when you would! Just think! the swallow that made that nest spent your

Photo: Stanley Crook.

The Swallow does not roof-over her nest, but likes to build it indoors when she can find a suitable place.

Photo: A. Brook.

SWIFT AT NESTING HOLE.

The Swift may easily be known by its very long wings. It never perches, but spends nearly all its time in the air, even feeding its young on the wing. Here it is clinging to the stonework before going in to the nest.

winter-time right away in South Africa. And now if you like to come with me, I will show you a swift. Just follow the ray of sunshine till you come to the hole in the wall, and then look out."

Creeping along cautiously, the children did as she told them. Then they waited, keeping very still and watching the outer wall.

Presently, out of the sky came a little, glossy, blue-black bird, with great long wings. Flying to a crevice, it hung for a moment or two to the stonework. It was a swift! The children had never seen one so close before. It waited a little, quite unconscious of their presence, and then crept in to its nest.

"Did you see how it hung to the stone?" asked their fairy guide. "That's a funny thing about a swift. He never perches, because all his toes are turned forward, so he can't hold on to a branch. But they are all the better for being like that when he wants to hang on to a wall. He does not even settle on the ground if he can help it, for his wings are so long that if he does he finds it very difficult to get up again!

"But now," she went on, "I've turned off the rain, so how would you like to come down to the river, and then I will show you where the little sand-martins live?"

"Oh, yes!" they cried.

So Summer rolled up her rain-cloak, and to the river she went with the children, a blaze of sunshine lighting her rose-petal gown.

Photo: Albert H. Willford.

On any sandy cliff may be seen little holes which are entrances to the Sand-martins' nests.

FULL SUMMERTIDE.

Photo: A. H. Hall.

At last these wide provinces of Meadowsweet that flank the river have whitened true to their allotted time.

14.—THE TIME OF MEADOWSWEET

By TICKNER EDWARDES

OVER the glassy surface of the river the martins are dipping and circling; now lifting into the mellow golden light of the summer's evening, now flying so low that every moment or two a curved black wing-tip cuts the mirror of waters, drawing from it a sudden note like a stroke on a tiny silver bell.

In the profound quietude of the evening this sound, inconsiderable as it is in itself, rings out with curiously arresting force. The day has been one of almost tropic heat, a fierce sun beating down from a cloudless sky, the air like the breath from an oven, the distant line of blue hills jigging all day long in tremulous haze—such a day on which the more timorous and easeful among humankind hug ingloriously the cool of the house or shady garden-close, coming abroad only when, with the declining light, the sultry air begins to rouse, and the first vine-leaf to tap softly at the window.

But such folk miss many wonderful and beautiful things, not alone of the torrid median hours of summer sunshine, but

inevitably also of the temperate golden eventides. To know ease, one must also know hardihood—half the pleasure of swinging downhill is born of the stress of climbing the steep—joy cometh in the morning only to one who has been stalwart under the sorrow of the dark. Evenings in high summer-time yield their full vision

Photo: E. Step, F.L.S.

Meadowsweet in full bloom never brings one the idea of a crowding mass of blossom. The pale greenish white of the inflorescence conveys the thought rather of clots of milky vapour caught in the tangle of greenery.

of loveliness to those alone who have not blenched at the white glare of torrid noon. The lowering sun still burns hot upon the cheek. But the tide has turned with the day, and with it a gentle zephyr is stealing up from the south. The great masses of weed afloat on the shining river, that have been stationary for a long hour back, are now beginning to move steadily seaward. The green reeds, hitherto stark and motionless, bend and tremble now in the flow, and their feathery purple tops set up a song of their own in the awakening breeze. Sweeter and more revivifying than all is the scent of the meadowsweet that comes only with the declining light. The river-side path runs through a whole vast jungle of it—a softly shimmering plane of white, each filmy plume bearing on its sunward side a touch of gipsy-gold.

As the summer wends on, one turns instinctively more and more to the river-side for the day's ration of wonder and beauty. Here the leaves of the great forest-trees retain their supple translucent green of youth long after the trees by the dusty lanesides have grown hard and brittle and opaque of foliage. The roses here look just as sweet and fresh and plentiful as in days of early June. By the river not a blade of grass has yellowed yet, while the wayside grass of the uplands is already tip-tinged and sere of hue. Laved by the perennial stream, the lush meadow levels seem only to take on a richer glow of flower-shine with every day of flaming summer that goes by. And now at last these wide provinces of meadowsweet that flank the river have whitened true to their allotted time. Yesterday's promise of a myriad silver buds has fulfilled itself in a myriad open flowers. Yet not flowers. The meadowsweet in full bloom never brings one the idea of a crowding mass of blossom. The pale greenish white of its inflorescence conveys the thought rather of clots of milky vapour caught in the tangle of greenery. It is all so diaphanous and indefinite: like the scarce visible wraiths of clouds that form and fade all day long in the remotest reaches of a summer sky.

With the meadowsweet, among flowers that love the riverside in late July, must be reckoned the willow-herb, with its vivid stars of carmine each enshrining a little ivory cross. As one follows the path in the ever deepening amber light, the white of the meadowsweet lies on the one hand and, on the other, the willow-herb, always gorgeous, shines with redoubled splendour in the ardour of the fast westering sun. Loosestrife, scarcely less brilliant, lifts its purple torches close down by the water's edge. A paler note is struck by the scabious: it throngs the footway at every step, filling the grass with its soft mauve disks. Over the beaten way itself long trails of lilybind

Photo: A. H. Hall.

A RIVER POOL.

By the river not a blade of grass has yellowed, and the leaves of the forest trees retain their translucent green.

wander reckless of the passer-by, the pink and white bells so plentiful, huddled so close together that they look like milk and wine spilled upon the ground. The bramble-brakes are in full bloom, smothered with tiny silken florets in pale magenta, and everywhere the wild convolvulus hangs out its great white trumpet flowers—whole

Photo: Henry Irving.

Among flowers that love the riverside must be reckoned the Willow-herb, with its stars of carmine each enshrining a little ivory cross.

strings of them swaying in the gentle evening breeze. But merely to set down the names of all the wild flowers that throng the river-path at this season would cover many pages. One might traverse miles of this enchanted way and never make an end to the chronicle of its living rainbow beauty, its thousand scents, its infinitely varied, unrepeated forms.

And when you have drunk deep and can drink no more at the brimming chalice of beauty set for all to quaff at every turn of the way, there is the great wonder-world —a veritable Aladdin's cave of marvels—to which, if you will, each living, growing thing of summertide may prove an open door. On this balmy evening, at close of a day of scorching sunshine, when the ponds have shrunk visibly since noon, and the very earth is cracking with the drought, your foot chances to strike deeper than its wont into the wayside thicket, and instantly a cascade of glittering water-drops is showered upon the path ahead. Dew already !—and the sun with yet a fathom to go ere the hill-crest will burn in his last crimson glances : a spring of crystal water in the furnace-throat of Sahara would be no stranger thing.

Dew it is, indeed, but not the new-born evening dew—that must be long hours yet in coming. This is the dew of overnight miraculously kept all through the long sultry day in the deep water-cups of the teasel, now emptied ruthlessly by your blundering foot. But a little way onward there is another teasel plant taller still and even more generously grown. You draw near and look upon it, soon at the very tip-tilt of wonder at what you see.

Breast-high the teasel stands, on all sides branching and rebranching from its central thick translucent stem. And where each pair of leaves springs from the central stalk, their broad bases unite, forming a reservoir filled almost to the lip with water even now, though the plant has stood in the hedgerow all through the heat and burden of the summer's day. Tier above tier of water-cups, and not one of them less than half full ; and how have they been replenished—for replenished they must have been in some way or other—against the horde of thirsty insects of a whole summer's day, and the still thirstier glances of the sun ?

A mystery it is, as well as a wonder. But there is something else about the common teasel more wonderful still. It is a fine conception truly—that of the old-time nature-lover who imagines the teasels benevolently set in the hedgerows as living wells of water for the thirsty bee. Doubtless many a winged creature sups its fill at these wayside fountains, and yet contrives to get harmlessly away. But the truth is, the teasel hangs its brimming chalices in the hedgerow for exactly the same reason

Photo: Henry Irving.

TEASEL.

Breast-high the teasel stands, on all sides branching and rebranching from its central thick translucent stem.

Photo: E. Step, F.L.S.

Purple Loosestrife lifts up its brilliant torches close by the water's edge.

as the spider spreads there her silken net. Both plant and net-maker are alike true flesh-feeders, cunning creatures of prey.

The insect that settles on the green teasel-leaves has little further chance of freedom than the gnat caught in the spider's snare. Every leaf leads down to the cool water-deeps, each a glittering blinding mirror for the sky above. Something there seems to be of mesmeric power in these flashing pools, that sooner or later draws thither every winged or creeping atom chancing upon the smooth, spined leaves. Look down now into any one of their glassy depths and own up to what you see: a score, perhaps, of dead drowned creatures, gnats and small flies mostly, but often larger things—caterpillars, woodlice, slugs, even an occasional bumble-bee —all have been made to "walk the plank" to their death. It is rather a disturbing notion, truly—this thought of a mere senseless vegetable catching living creatures for its food. But the fact is not to be evaded. Come again in a few days' time, looking into the same teasel-cups, and you will see a curious change in their contents. All is fast passing into disintegration—settling to the bottom of the water in a formless slime: the plant, in fact, is digesting its food, and will eventually absorb the matter into its tissues. If one has a taste for botanical dissection—from which may a kindly Providence all of us forfend!—the teasel may be sliced vertically apart at the junction of stem and cup, and the tell-tale ducts discovered. The pageant of Nature, like all pageants, owes some at least of its allurement to its deft alternation of light and shade.

While I have been wandering and musing thus on the old river-path, time and tide have been gliding imperceptibly by. Sun and water have sunk together—the one behind the pine-fringed sierra of western hills, the other deep into its oozy channel between the double avenue of whispering reeds. The western sky is just a glittering sheet of copper-foil, against which the pines make a coal-black fretting; and through the ever-deepening blue of the east the first star of night has pierced at length—a single water-white spangle hung in heaven, strangely at odds with the glowing amber of the hills beneath.

To watch these sweltering summer days merge gradually into summer night—the dim wan radiance of the crescent moon and flinching silver of the stars by little and little overcome the last faint glory of the vanished day—is to be carried off willy-

nilly on some magic witch's-broomstick into another world. Deep within its darkness of reeds the river wends by, undiscernible but for the silvery crests of its ripples and its low quiet song. A whole host of night-flying creatures has suddenly got on the wing. Over the plane of meadowsweet innumerable white moths flicker and sway in the pallid dusk. The bats are out in whole companies veering to and fro across the singing gloom of waters, just as the martins were doing in the sunshine hours ago. Incessantly great dor-beetles go by overhead with their deep note like a sudden blare from a bassoon. The dense riverside growth is instinct with new-rousing life—the scurry of some heavy four-footed thing, almost certainly an otter, the musical plunge of a rat taking the water, the shrill-voiced anxious call of a moor-hen to her chicks strayed among the reeds.

And then at last begins the sound which, above all others, seems to voice the glad serenity of the summer night. When the fern-owls commence their weird jarring chorus high up in the oak-boughs—especially when the eerie sound starts precipitately, as it nearly always does—the steadiest may scarce restrain a catch at heart and a furtive look behind him. And yet it is essentially a joyous note, for all its mystic, elfin quality. One hearing the fern-owl's song for the first time often deems it unbelievable as voice of bird. It is like nothing on earth now. But if one could carry one's self back into centuries gone by, and hear again an old cottage echoing to the quiet music wrought by the housewife busy at her spinning-wheel, that would be the nearest thing to the fern-owl's quaint vibratory strain. Up in the dim oak-branches now against the star-shine, there might be a score of ghostly spinners busy at their wheels.

Photo: Riley Fortune, F.Z.S.

Everywhere the Wild Convolvulus hangs out its great white trumpet flowers—whole strings of them swaying in the gentle evening breeze.

On the banks of the Loddon, a sluggish tributary of the Thames, the Snowflake or "Loddon Lily" grows in profusion in the wet soil.

15.—LODDON LILIES

By A. HAROLD BASTIN

With photographs by the Author

OUR native members of the Amaryllis tribe (*Amaryllidaceæ*) are three in number—the daffodil or "Lent lily," the snowdrop, and the snowflake or "summer snowflake" as it is sometimes called. Of these, the last named is not, perhaps, truly indigenous, nor can it be described as a common wild flower, although it is found occasionally in moist meadows in many parts of England, more especially in the eastern counties. Its chief stronghold, however, is the valley of the Loddon—the sluggish tributary of the Thames which enters that river through its right bank several miles above Henley and a little below the village of Sonning. Here the plant flourishes in the utmost profusion, and its predilection for moisture is clearly seen, for the wetter the soil the more luxuriant are the masses of narrow, keeled leaves which spring from it. Often one finds large clumps springing from banks of slimy mud only an inch or two above the level of the water, while the plants frequently grow actually *in* shallow water along the river's margin, as may be seen from the photographs which are reproduced on these pages.

Like the daffodil and the snowdrop, the snowflake—or "Loddon lily" as it is called locally—is a perennial, and springs from a bulb. A large clump, which has been developing undisturbed for many years, will be found to consist of hundreds of closely-set bulbs, each of which, when mature, sends up a spike of blossoms. During the winter many of the clumps lie deeply submerged under the flood-water;

LODDON LILIES.

A clump of Snowflakes or "Loddon Lilies" growing on a mud-bank.

but when this abates, and the first impulses of spring's advent make themselves felt, the leaves begin to appear. Books say that the snowflake flowers in May, and certainly great armfuls of the blossoms may be gathered during this month; but in a "forward season" the first spikes make their appearance as early as the last week of March. If these early spikes are gathered as soon as they are seen, and placed (with their stalks in a large vessel of clean water) in a sunny window, the blooms quickly expand. These "forced" spikes last well, and are doubly welcome at a time when wild flowers are still scarce.

In appearance the Snowflake (*Leucojum æstivum*) flower-spike resembles a bunch of large snowdrops with green-tipped sepals and petals.

In appearance the snowflake flower-spike, or inflorescence, resembles a bunch of large snowdrops with green-tipped sepals and petals, supported by a succulent, two-edged stem, two feet or more high. Lusty spikes, springing from the water, will often be found to exceed three feet. The developing flower-buds are protected by a bract or spathe of thin, papery consistency. Perhaps six is the normal number of buds; but there are often more, sometimes fewer. They open in succession; but as they do not fade quickly, the spike at its best is a handsome cluster—quite as attractive as many of the "polyanthus" narcissi for which high prices are asked in the florists' shops.

From the technical standpoint the snowflake differs sufficiently from the snowdrop to warrant the generic separation of the two plants. Thus, while the snowdrop is called *Galanthus*, the snowflake's name is *Leucojum*. The chief reasons for this are: (1) That in the snowflake all the six segments or leaves (sepals and petals) of the perianth are of equal size, while in the snowdrop those of the inner whorl (petals) are smaller than those of the outer whorl (sepals); and (2) that in the snowflake the anthers open in longitudinal slits for the discharge of the pollen, whereas in the snowdrop the top only of each anther opens.

These may seem unimportant points; but we must bear in mind that close attention to details of this sort has in the past often resulted in far-reaching discoveries bearing upon that great problem that we call "the origin of species"; discoveries which have made it possible to suggest "reasons" why a species has found it convenient to diverge, or split up, and become *two* species—in a way comparable to that in which a unicellular plant or animal, by the process called "fission," divides its substance and its "self," and becomes *two* individuals. Of course, it is not suggested here that the snowdrop and the snowflake are necessarily the direct descendants of a common ancestor. Before we shall be in a position to pass a decisive judgment of this

kind, we shall have to add greatly to our knowledge concerning (1) the pressure of those outward circumstances which we call "environment," and (2) the mode of response thereto of that mysterious inner principle—call it "life," "mind," "spirit," or what you will—which is manifestly the dominant factor in evolution.

The *raison d'être* of the snowflake's blossom, judging from the standpoint of the plant itself, is to attract insect pollen-carriers. Of course, these busy-bodies expect payment for their services; and their reward usually takes the form of the mellifluous juice called "nectar." But the snowflake has no "nectaries." Its style, however, is surrounded by a cushion of loosely packed cells which, when probed and sucked, yields a delicious mucilage. Pendent flowers, such as the snowflake, are not favourites with ants, beetles, and many kinds of flies, which gain access to the corolla only with difficulty. But bees are not easily nonplussed, and seem actually to prefer these flowers—perhaps because they have few competitors to fear!

The scientific name of the snowflake (*Leucojum æstivum*), given to it by the great Linnæus, seems curiously inappropriate. *Leucojum* is derived from two Greek words signifying a "white violet." True, the snowflake is white; but one fails to trace any obvious resemblance (except, perhaps, in its scent) between it and a violet. So, too, with the specific name *æstivum*, which says, in effect, that the flower is a flower "of the summer." Yet the traditional flowering time—May—is not strictly a summer month; while, as we have seen, the snowflake actually begins to bloom much earlier, and is, in fact, definitely a flower of spring. Those who are interested in gardening experiments find that the snowflake is not a difficult subject to deal with. The writer once knew an old lady who cherished a fine clump for years in a large pot of earth which was kept constantly standing in a bucket of water. But the bulbs will thrive quite well in any moist corner, not too shady, provided that the soil is kept well watered.

Large clumps of Loddon Lilies will be found to consist of hundreds of closely-set bulbs, each of which, when mature, sends up a spike of blossoms.

Photo: R. Cassteet

The snout of the Hedgehog is markedly pig-like, and the neck is scarcely perceptible. Because of his nocturnal habits, he is not seen by the casual rambler so frequently as might be expected

12.—OUR LARGEST INSECT-EATER: THE HEDGEHOG

By CLIFFORD W. GREATOREX, F.Z.S.

EVERYONE knows the hedgehog, or urchin. It is one of the most plentiful of our mammals, and is recognized at once by its spiny covering, and by this feature may be distinguished from every other form of animal life inhabiting these isles. Yet, despite its comparative abundance, it is not seen so often by the casual rambler as might be expected. Unless one comes across it in the dusk as it runs over the quiet roads or along the hedge-banks, it has to be sought; and to track it to its hiding-place is not always easy. The hedgehog, in fact, as a rule ventures abroad only with the coming of night, and returns into seclusion with the dawn.

Were the hedgehog rare instead of being so common, it would be regarded as one of the wonders of the universe. One naturalist states that the hedgehog's spines number about two hundred and seventy to the square inch, and that, on an average, there are no fewer than sixteen thousand of these structures on the skin of an adult. The spines are dirty white in colour, ringed near the middle with brown or black. Seen beneath the

microscope they are found to be marked by numerous parallel grooves, arranged longitudinally. The coarse hair on the face and on the under-surface of the body is yellowish white.

The snout of the animal is decidedly pig-like; the neck is scarcely perceptible;

Photo: S. B. Johnson.

One of the chief peculiarities of the Hedgehog is his power to roll himself up into a ball. He is about to begin curling—

the body is oblong, convex above. The legs are remarkably short. As it obtains most of its food near or upon the ground long limbs are not needful. The short legs and the flattened feet cause the lower surface of the body to be carried very close to the ground. Indeed, the animal progresses with a curious waddling motion, although it can run quickly when occasion requires. The claws are long and flattened, clearly not intended for burrowing. The ears are short, broad, and rounded. The bright eyes are of moderate size. The tail is short, not exceeding one and a half inches in length. The total length of the hedgehog's head and body, exclusive of the tail, is usually about ten inches.

The hedgehog is the largest British representative of the Order to which it belongs—the *Insectivora*, or insect-eaters. The very largest of its relations is the tenrec, a native of Madagascar, but even this species does not measure more than two feet in length. The tenrec enjoys the distinction of producing about twenty young at a birth!

One of the chief peculiarities of the hedgehog lies in its power of rolling itself up into a ball. In this attitude it presents an impenetrable array of spines that protect it admirably against most of its foes, and it does not unroll until it is sure that its enemy has withdrawn. However, even this formidable armoury does not save it against the attack of the badger. Old Brock's powerful claws soon force the tightly curled body asunder, and once a hold of the soft underparts is secured, the defensive spiny coat is of no avail. Reynard the fox also includes the hedgehog occasionally amongst his victims. A correspondent informs me that he has seen a polecat leap upon an unwary hedgehog, seizing it by the throat before it has time to adopt the defensive attitude. Again, dogs sometimes manage to kill it. I knew of an Alsatian wolf-hound that, when accompanying its owner on his walks in a locality where hedgehogs abounded, took great delight in dragging the poor things from their retreats, and by the aid of claws and teeth soon reduced even the strongest of them to a mass of blood-sodden flesh and spines.

None the less, the hedgehog's spiny coat has ever been of excellent service. Evolutionists affirm that but for this

Photo: W. S. Berridge, F.Z.S.

—and here he is rolled up into a spiny ball, which protects him effectively from most of his foes.

protective armour the species would have disappeared many ages ago from the ranks of the living, or, like the water-shrew, it would have been obliged to adapt itself to an aquatic mode of existence—unless, of

course, it had managed to acquire the art of dwelling underground, after the fashion of the mole. The power of rolling up into a more or less spherical form is due to the extreme development of a certain layer of muscles—the *panniculus carnosus*—lying beneath the skin. Most mammals have this layer of muscles, but in the hedgehog it is developed to an extraordinary degree.

Usually the hedgehog is a silent animal, though when excited it utters a curious sound that has been described as being "between a grunt and a low, piping squeak." When caught in a trap it raises its voice in pain and fear. No humane man having heard that pathetic cry could repeat the offence of trapping the poor beast. Once when I was watching the gambollings of a party of young badgers in the heart of a wood, I heard a snuffling sound in the tall grass near to where I lay concealed. Investigation revealed a fine hedgehog engaged in devouring the dead body of a linnet.

This incident brings us to the subject of the hedgehog's food—an important matter, for although its usefulness as a destroyer of cockroaches (wrongly termed "black-beetles") is generally recognized, it is all too true that farmers and gamekeepers *do not* extend to our spiny friend anything like due protection. Indeed, the gamekeeper kills hedgehogs whenever he can find them.

Its diet is varied, including both animal and vegetable substances. Great numbers of insects, in all stages of development, are devoured; and many of them are of kinds that are harmful to the interests of the agriculturist. Slugs, snails, earthworms and centipedes are favourite articles of food, nor does it hesitate to kill rats and mice and other small mammals. There is recorded an instance in which this really powerful little animal actually attacked a leveret, and would have overcome it but for human interference. I have myself found a large hedgehog feasting on the body of a young rabbit; but since the body was quite cold, there was no proof that the spiny-one had killed it. Lizards, snakes,

Photo: J. C. Bristow Noble.

The nest of the Hedgehog is composed of dried leaves, grasses and sometimes moss. The young are born blind and without quills. At least four weeks elapse before they are able to roll up into the defensive attitude.

Hedgehogs are excellent parents and the young remain with them until they have attained considerable size—

Photos: J. C. Bristow Noble.

—a fact that has bearing upon the successful way in which the species has held its own in a world that abounds in dangers to youngsters.

Photo: H. Mortimer and Wm. B. Batten.

Roots, fruits, lizards, frogs, toads and newts are included in the Hedgehog's bill of fare, and a snake provides him with an additional dainty.

frogs, toads and newts are included in the hedgehog's bill of fare. One naturalist saw a hedgehog enter a shallow pool to catch a newt. To birds' eggs " Old Prickles " is partial ; but an unbiased judge would dispute the gamekeeper's allegation that he is an inveterate robber of pheasants' nests. Truly, hedgehogs are caught very readily in traps baited with eggs, but that does not afford condemnatory evidence. A friend of mine, addicted to curious experiments, once caught a stray cat in a trap baited with a boiled piece of dog's flesh ! Surely no one would assert, therefore, *that cats feed largely on dogs.* Further observation is needed before any naturalist would sanction the wholesale destruction of the hedgehog at the hands of the gamekeeper. Up to the present, careful study of the question shows that our largest insect-eating wild animal does far more good than harm.

It has long been known that the hedgehog devours snakes. Usually the snake is incapacitated by a succession of sharp bites. A well-placed grip will sever the backbone ; then, of course, no further attack is needed. Should the hedgehog be assaulted by its intended victim, it curls up at once, and when the reptile strikes it inflicts injury upon itself alone.

The annotator of that charming but frequently inaccurate work, Oliver Goldsmith's " History of the Earth and Animated Nature," remarks that one naturalist " had in his house a female hedgehog kept in a large box, and which soon became mild and familiar. He often put into the box some adders, which it attacked with avidity, seizing them indifferently by the head, the body, or the tail." However, recent observers would hardly agree that such is the hedgehog's ordinary method of dealing with the dangerous viper. But it is a fact that the urchin will and does attack and *eat* the only poisonous snake found within our shores, and such a service renders it even more valuable to mankind.

Roots and fruits of various kinds are included in its dietary. In an orchard it will feed freely upon fallen apples, pears, plums, and cherries. Very quaint is the antique notion that it actually impaled these succulent morsels upon its spines by rolling on them, and then carried them home to eat at leisure in its retreat.

Equally untenable is the idea, still prevalent in some parts of the country, that the hedgehog steals the milk of cows as those ruminants rest on the grass. A glance at the shape and size of the insect-eater's mouth, or a brief examination of its teeth, would show how foolish such a fancy really is.

The hedgehog spends the day sleeping in a cavity under the roots of a hedgerow tree, a hole in a bank or wall, or in the depths

of a thicket. Usually it does not venture out until dusk; but, occasionally, it is seen searching for food long before the sinking sun heralds the reign of darkness. However, this deviation from rule is due to some urgent circumstance. There may be young clamouring for food. Every mammalian mother must see to it that she herself is adequately nourished if her babes are to thrive; for it is from her lacteal glands that they derive their sole support during infancy.

Hedgehogs are excellent parents. The nest, hidden in some spot such as serves for the diurnal slumber, is constructed very carefully. Rain is excluded by means of a roof. The whole structure is composed of dried leaves, grasses, and sometimes moss. I once found a hedgehog's nest in which particles of rabbit's under-fur were mingled with the ordinary materials.

Newly-born hedgehogs are blind, and are at first without quills. The spines begin to appear within twenty-four hours after birth, and they are at first white, very soft, and flexible. Later they harden and assume the colour of those of the adult. At least four weeks elapse before the young urchin is able to roll itself up and present a fairly sound defence against attack. Parents and young often remain together until the latter have attained considerable size. This fact has bearing upon the successful way in which the species has held its own in a world that abounds in dangers to youngsters who walk abroad before they are well able to look after themselves.

Probably more than one litter is produced in the course of the year. The number of young at a birth is usually four or five.

The hedgehog is a hibernating animal. With the approach of the cold season it retires into some suitable shelter in the heart of a hedgerow, shrubbery, or coppice. A hollow near the base of a tree affords a favourite snuggery, or the family nest may be used. The winter home is made comfortable by the introduction of leaves and moss. No store of food is accumulated, and unless there be a spell of exceptionally mild weather, the hedgehog is a sound sleeper.

The hedgehog is found throughout the whole of England, in parts of Ireland, and as far north as the middle of Scotland. It was probably introduced into the Shetlands by human agency.

Photo: Stanley Crook.

With the approach of the cold season the Hedgehog retires into some suitable shelter and sleeps the winter through.

Photo: Frances Pitt.

The Pipistrelle, or Flittermouse, bears an excellent character; he robs not the farmer's corn; blocks not his rain-pipes with his nests, nor is he destructive of flowers and fruit.

13.—PIPISTRELLE, THE FLITTERMOUSE

By H. W. SHEPHEARD-WALWYN, M.A., F.R.Met.Soc., F.N.B.A., F.Z.S., F.E.S., etc.

TO many people a bat is a bat—to be ignored, or gazed at with mild interest, as the case may be, to be fled from by ladies obsessed by the conviction that a bat's dearest object in life is to entangle himself in their hair. I never could understand the feelings of horror and dislike with which so many seem to regard the harmless but necessary bat. Were some mysterious murrain unexpectedly to exterminate all the bats, these very ladies would assuredly be the first to cry to Heaven to send them back again; I forget how many hundreds of mosquitoes and such insects it has been computed that one of these nimble little fellows can account for during his evening constitutional. And if he should be so tactless as to intrude upon the sanctity of a lady's bedroom on a sultry June night, believe me it worries him every whit as much as the lady, and the battery of sponges and towels directed at his swiftly dodging little dusky form will usually achieve no result beyond the destruction of ornaments and other feminine fripperies.

He is one of the few creatures we have with not a single black mark against their name. He never filches the farmer's corn nor blocks the rain-pipes with his nests; to him the tenderest leaf-buds or choicest blossoms are anathema, while the rosiest of strawberries or greenest of green peas will leave him cold. He would not dream of robbing a bird's nest or gnawing the bark of young trees, he has never been known to uproot bulbs or snip off polyanthus heads out of pure devilry, nor has he even been convicted of throwing up unsightly mounds of earth in the middle of the lawn—in a word, it is not by any means his wings alone

which entitle him to rank among the angels! And yet, those learned in the lore of the Middle Ages will tell us that it was the fashion to rank him with the angels of darkness rather than of light. Strange tales, indeed, has the long arm of legend brought down to us of dire happenings in haunted caves, and even nowadays the natives of certain far-off climes are wont to interpret them as evil spirits. Thus will popular prejudice saddle the possessor of suspicious habits with a reputation that he is very far from deserving.

Long years ago pipistrelle was held to be a bird. Aristotle thought that bats were birds with wings of skin, and Pliny describes them as "the only birds that do not lay eggs"; even in these enlightened times, were the question to be included in an elementary school examination paper, I venture to predict that a considerable percentage of answers would favour the bird theory. To many more it would no doubt be news that there are no fewer than nineteen or twenty British species of bat.

The structure of a bat's anatomy is so remarkable that it demands a moment's consideration. To quote a certain medieval writer—"biped, quadruped; walking, but not with feet; flying, but not with feathers; seeing without light, in the light blind . . ."

The photograph on p. 669 shows pipistrelle asleep, suspended from the strip of bark that I placed in the cage for his delectation. "Pip" was the obvious abbreviation with which I christened him, and though I never quite succeeded in getting him to answer to it, I have a strong suspicion that he knew what it meant. It must be highly disagreeable to sleep head downwards if one is not used to it, but no doubt any habit inherited through ten thousand generations would seem orthodox and natural. In the picture we see his back view, the pretty transparent ears being plainly visible. The objects on either side that look like crutches are in reality the main shafts of the wings, on the extremities of which a brace of powerful hooks enable the creature to attach himself with greater security to his resting-place. Anatomically speaking, the wing is really nothing more nor less than the fore-leg,

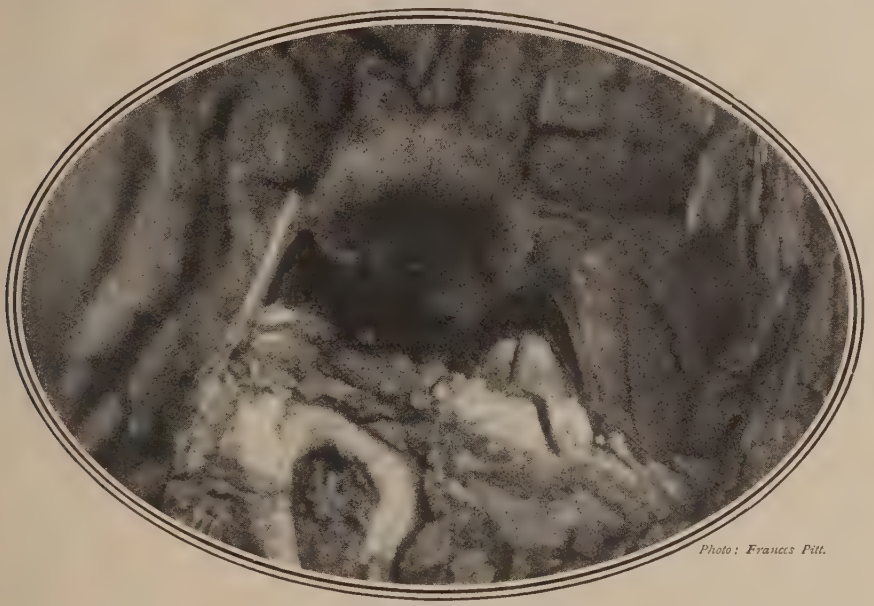


Photo: Frances Pitt.

Formerly, Pipistrelle was held to be a bird. Aristotle thought that bats were birds with wings of skin, and Pliny describes them as "the only birds that do not lay eggs."

draped with a broad flapping curtain of leathery membrane, which when not in use is kept folded up like a flag wound round its pole. This is evident when the creature is walking—if one may dignify with such a name his comical shuffling mode of progression—the aforementioned hooks coming into action under the guise of feet. The best way of describing the unfolded wing is to compare it to a section of an open umbrella, the powerful transverse ribs aiding not a little in bearing out the simile. The membrane that composes the wings is continuous in most bats, enclosing the hind-legs in the same manner as the fore-legs, with the exception of the feet and sometimes a portion of the tail. The latter does yeoman's service in the capacity of rudder.

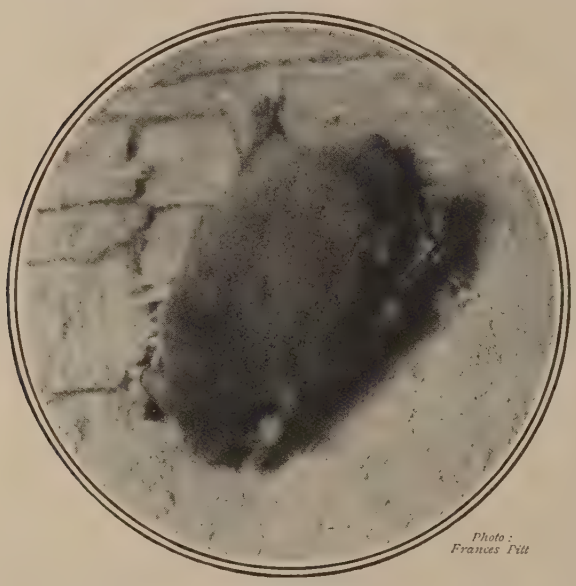


Photo: Frances Pitt

Pipistrelle suspended head downwards by one claw. His whole body is covered with soft, reddish-brown fluff.

Soft, reddish-brown fluff, of the texture of a day-old chicken, covers the whole body; the features of his face are very clearly defined, the minute black eyes wearing an expression of extraordinary alertness and intelligence, and when he snarls—as he usually does if he is poked—there come into play an array of teeth calculated to strike terror into the stoutest heart, although actually the most sensitive human skin would scarcely receive any impression from the contact. We have already dealt cursorily with the question of his food, but I found in the case of "Pip" that there was not an insect in the entomological calendar that he would relish half as much as a juicy scrap of raw meat. Notwithstanding, he would greedily snap up any stray moths that might chance to be on the wing when I let him out for exercise in my room.

"Blind as a bat" is usually regarded as the acme of scornful invective to be flung at the head of anyone who has failed to find some lost article as quickly as we can find it ourselves, although the appropriateness of the comparison is anything but borne out by the actual facts. The tiny bead-like objects which serve our friend pipistrelle as organs of vision are of a highly efficient character, although so fundamentally dissimilar from those of most nocturnal creatures. It has been suggested that the proverb owes its inception to the belief of his being unable to see in daylight, but I for one can hardly reconcile this with the testimony of my own eyes. I was working in the garden one day last summer when a bat suddenly appeared from nowhere, and hawked flies in the blazing sunshine for over half an hour ere he eventually took himself off again! At the same time, it is an indisputable fact that the bat possesses some other mysterious sense which acts as a means of guidance.

A variety of interesting and conclusive experiments have been made in this connexion, although had I lived a hundred and fifty years ago I should most emphatically have put the R.S.P.C.A. on the track of a certain clever but inhuman Italian scientist for the barbarity of the methods which he employed to achieve his purpose. I shrink from sullying the biography of pipistrelle by entering upon anything in the way of detail, so let it suffice to record that he blinded the poor little beasts, and then discovered that they could guide themselves every whit as well as they could before!

Several of them were released in a long passage, where they flew to and fro without attempting to strike against the walls, even turning in a perfectly natural manner each time that they reached the end. When a hand was held up before them they darted aside to avoid it, and even passed without brushing their wings against a network of sticks that was erected across the passage. But here comes the most extraordinary part of all. At a certain point in the roof was a small cavity, which one of them suddenly sensed in passing, and immediately struck off at a tangent to hide himself in this retreat!

Deducing from these and other similar experiments, the great scientist Cuvier announced his conclusion that this uncanny power of guidance without vision is due to an extraordinarily developed sense of touch in the extremities of the wings, enabling the bat to feel in his mind—if one may put it so for better comprehension—the presence of any obstacle within the radius of a certain distance. Those of us who have ever watched carefully a man who has been blind for years, and noticed how he feels his way about, the outstretched hand frequently causing him to turn and avoid an obstacle without having actually touched it, will perhaps be the more disposed to endorse this opinion.

Pipistrelle—or flittermouse, as he is often termed colloquially—is one of the two or three commonest British species, and the long-eared bat is another. The chances might be reckoned at a hundred to one that the dusky figures which we see flitting silently among the shadows at dusk belong to one or the other of these species. Some bats are adorned with a very odd arrangement of membrane, like a spray of leaves in appearance, covering the space round the nose and between the eyes, of which the most conspicuous British species is the horseshoe bat. This little fellow seems to hate the light more than any other kind, leaving home later and returning earlier than his relatives, and taking up his abode in such dark and gloomy recesses that anyone with an antipathy for ghosts would certainly think twice before offering to share it with him. The barbastelle is one of the less common species, and can readily be distinguished from any other by his much darker colouring, being nearly black on the upper side. Then there is the noctule, the largest of our British species. He measures about three inches in length, and the wings when spread span no less than fourteen inches.

Photo: H. W. Shepheard-Walwyn, F.Z.S.

Pipistrelle asleep upon a strip of bark shows his pretty transparent ears and the main shafts of his wings like crutches on either side.

"Where do the bats go in the daytime?"

is a question that has frequently been put to me. "Pip" used to creep between two strips of bark with which I had provided him for the purpose. In his natural surroundings pipistrelle slips into some crevice in any kind of crumbling brickwork, under the eaves of outbuildings, in the hollow of a tree-trunk, or a variety of such places. I came upon a colony of several dozen once in the attic of an old house in Sussex, where they had managed to effect entrance through a diminutive hole beneath the eaves. In such retreats they pass the winter, cosily packed away in clusters like a bunch of bananas. The horseshoe bat has a preference for the darkest places to be found, rocky caverns for choice; the long-eared bat is apparently of a more religious disposition, showing a decided partiality for church towers or cathedral cloisters, while the noctule scorns any sort of building and always patronizes hollow trees.

We must not omit to dwell for a moment on the family arrangements of pipistrelle, if only on account of the fact that they are entirely unlike those of any other living creature in this country. I believe one might find quite a substantial proportion of normally enlightened persons inclining to the opinion that bats lay eggs—and small blame to them. I must confess to the same weakness myself when I was young and verdant. After all, if a bat is a bird, why should it not lay eggs? As a matter of fact, pipistrelle's baby is born in the same manner as that of any other animal—and I put it in the singular advisedly, for it is very rarely a question of more than one at a time. It is not unlike a young mouse at its first introduction, only much more "leggy," blind, skinny, naked, and altogether a thoroughly revolting object. The mother feeds him in the same manner as all the other members of the mammal order, but when she goes abroad for a constitutional she neither leaves him at home nor puts him in charge of a nurse. Baby digs his little claws into her matronly bosom and sticks to her soft, warm fur like a leech, and by night or by day, at home or abroad, in resting or in flight, like Mary's lamb, wherever mother went the babe is sure to go.

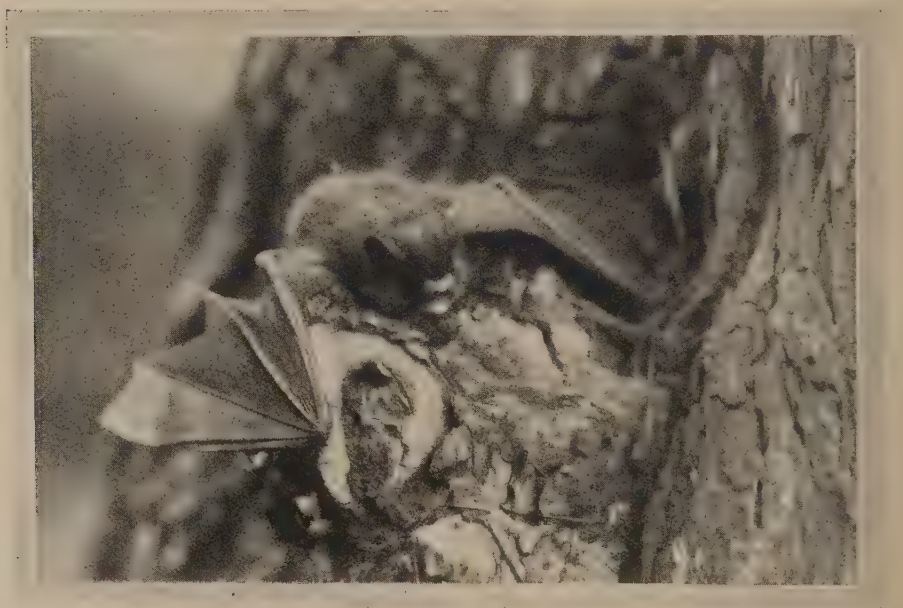


Photo: Frances Pitt.

Pipistrelle, with wings spread for flight, about to rise into the air. Before doing so it squeaked defiance at the photographer.

Dwellers in Shells

Photo:
T. Russell Goddard, F.L.S.

The Garden Snail (*Helix aspersa*) is one of the most highly developed and adaptable of European species, and can accommodate itself to a wide range of climate and temperature.

1.—THE COMMON GARDEN SNAIL

By T. RUSSELL GODDARD, F.L.S.

MOST people in this country regard snails as creepy, slimy things and dismiss them from their minds without further consideration. Those who possess gardens look upon them as enemies to be sought for assiduously with a view to their speedy extermination in a horrible mixture of salt and water. Modern tillers of the soil are not the only ones who have suffered from the snails' depredations, for we find that they were looked upon with equal disfavour as long ago as the tenth century. A quaint exorcism of the holy martyr Trypho of Lampsacus is worth quoting in this connexion—"O ye Caterpillers, Worms, Beetles, Locusts, Grasshoppers, Wooley-Bears, Wireworms, Palmerworms, Snails, Earwigs, and all other creatures that cling to and wither the fruit of the Grape and all other herbs, I charge you by the many-eyed Cherubim and by the six-winged Seraphim, which fly around the Throne, and the holy Angels, and all the Powers, etc., etc., hurt not the Vines nor the land nor the fruit of the trees nor the vegetables of ———, the servant of the Lord, but depart into the wild mountains, into the unfruitful woods, in which God hath given you your daily food."

Notwithstanding the fact that it has been considered an obnoxious garden pest throughout the ages, and the many persecutions it has suffered in consequence, the garden snail (*Helix aspersa*) has succeeded in establishing itself in almost every quarter of the globe. It is one of the most highly developed and adaptable of European species, and can accommodate itself to extremes of climate and temperature. It is as capable of thriving at an altitude of 4,000 ft. in the Alps and the Pyrenees as it is in the neighbourhood of the equator.

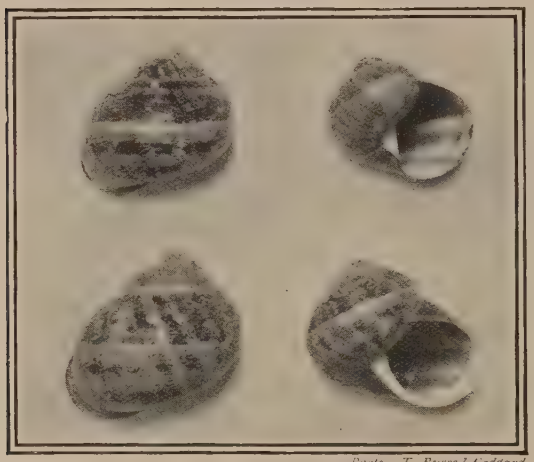


Photo. T. Russell Goddard.

How the shell of the Garden Snail develops: At the top is an immature specimen without lip; the bottom one is mature with lip. The shell is opaque.

With the exception of the edible snail (*Helix pomatia*), which is found only in a few of the south-eastern counties of England, the garden snail is the largest of our British terrestrial species.

The snail is usually blackish-grey in colour, but varies very considerably. Lighter tints are quite frequent, and occasionally yellowish or pink specimens are found. The greater portion of the body, containing the vital organs, is enclosed within the shell. The part upon which the creature moves is called the foot, and movement is effected by means of a rapid succession of muscular waves passing from behind forwards. These waves may be easily seen if a snail be allowed to crawl over a piece of plate glass. The head is situated above the fore part of the foot and bears a mouth and two pairs of tentacles. The upper pair of tentacles are long and slender with distinct bulbous extremities, in which the eyes are situated. The lower tentacles are about one-fourth the length of the upper ones, and appear to be organs of touch. Just inside the mouth there is a single horny jaw which may be seen in action when the snail is crawling up the inside of a glass jar, or feeding upon a leaf. When the snail is fully extended the mantle visibly fringes the mouth of the shell. The breathing orifice may also be seen on the right-hand side.

The shell is opaque, and at maturity consists of four and a half to five whorls; its size and thickness vary considerably according to locality and conditions of life. As a rule the height and diameter are about 35 mm. Near the sea the shell is often much smaller, and where there is a deficiency of lime in the soil it is usually thin and fragile.

The whole of the exterior of the shell is covered with a thin semi-transparent membrane or epidermis.

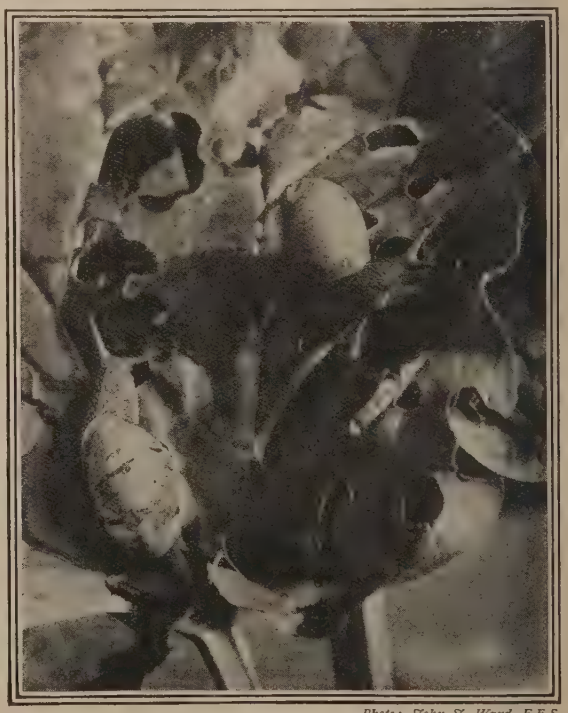


Photo: John J. Ward, F.E.S.

A rhubarb leaf with perforations, which show the extent of the meal the two Garden Snails have made.

The ground colour is yellowish or fawn, irregularly banded and marked with purplish-brown or chocolate pigment. The lines of growth are well marked and the lip is white.

Although the garden snail does not vary to the same remarkable extent as the smaller five-banded woodland snail (*Helix nemoralis*) which is also found in gardens, a number of varieties occur. The variation is usually in the depth of colour, or the markings of the shell. Specimens from very damp, peaty, or marshy districts are dark in colour; in Ireland they are often almost black. Sinistral or left-handed specimens—in which the whorls are turned to the left instead of to the right—are occasionally met with, and more rarely monstrosities in which the whorls are abnormally elevated, or even completely disconnected.

Garden snails frequent cultivated land in the neighbourhood of dwellings and hedgerows. They are partial to old walls covered with ivy, and often make their headquarters in a clump of nettles. They are crepuscular in habit, coming out to feed in the early morning, and again in the evening, but during the daytime they remain at rest in their hiding-places; a shower of rain, however, will tempt them out, even at mid-day. The homing instinct is very strongly developed, and garden snails will often cross a rough and difficult piece of ground in search of their favourite food, returning by the same path to their old quarters rather than find other hiding-places near the new food supply. Their sight is poor and of very short range, but the sense of smell is highly developed. They are not particular with regard to their food; in fact, they will eat almost anything of a vegetable nature, although individuals have their own particular preferences. Cabbage and lettuce are favourite articles of diet, as gardeners are fully aware.

Garden snails are sensitive to cold and hibernate during the winter. Large numbers congregate at the roots of shrubs, at the foot of walls, or in hedge-bottoms, and bury themselves several inches in the ground for warmth and protection. The

Photo: John J. Ward, F.E.S.

When winter comes the Garden Snails in some mysterious way arrange for a common hibernating place, where they remain "glued" down until spring returns.

mouth of the shell is closed with a thin membranous epiphragm. Others cluster together in holes in rocks or walls in order to hibernate. As it grows colder the snails retire farther into their shells and spin additional epiphragms. Sometimes as many as six or eight are added. They are capable of withstanding eighteen degrees of frost. Immature specimens are more resistant to cold than mature animals. It is doubtful whether snails breathe or not during hibernation, but it has been proved by experiment that they can survive

Photo: J. T. Newman.

Foremost among the enemies of the Snail is the thrush, which smashes the shells against a stone.

complete deprivation of atmospheric air for a considerable period.

Garden snails are hermaphrodite, and pairing takes place soon after awakening from hibernation, which is seldom before April in this country. The eggs, which are roundly oval in shape, and covered with a tough white membranous envelope, are laid soon afterwards. They are deposited in holes excavated at the roots of herbage, or at the foot of trees, and covered with a little earth. They adhere together by means of a colourless sticky mucus, and hatch in from fifteen to thirty days according to the weather. The young when hatched bear a glossy unbanded reddish-grey shell of one and a half whorls. They feed and grow gradually throughout the summer and hibernate through the winter. Upon emerging in the spring they are very hungry and become so gorged with food that it is impossible for them to withdraw into their shells. Growth is then very rapid, and they are capable of adding 30 mm. to the shell in the space of a fortnight. The shell, which consists largely of carbonate of lime, is secreted by the mantle. Full growth is attained twelve to fifteen months from hatching. Most individuals die or are destroyed during the second hibernation, but specimens in captivity have attained ten years of age.

Garden snails have many enemies, and foremost amongst these are thrushes and blackbirds. Everyone who lives in the country is familiar with the former bird's habit of taking snails to a particular stone against which the shells are smashed. Such a stone is popularly known as a "Thrushes' Altar." Hedgehogs, rats, mice, and other small mammals prey upon snails to a large extent, and numbers are destroyed by insects such as ants and beetles.

Garden snails are not entirely useless from man's point of view. They have been used as food from prehistoric times down to the present day. Large quantities of the shells of this species have been found in the caverns of Stone Age man, both in this country and on the Continent. Although the edible snail (*Helix pomatia*) was the species most favoured by the Romans, and cultivated by them for culinary purposes, the common garden snail was also included in their dietary. The Belgians, who consume large quantities of terrestrial snails, prefer the common garden species to the larger edible snail. Garden snails are also much used for food in the West of England, and numbers of persons find an occupation in collecting them in the country districts of Gloucestershire and Somersetshire. They are taken into Bristol and Bath markets, and sold under the name of "Wallfish." They are rather insipid, but are said to be as nutritious as calve's-foot jelly when stewed in milk.

Glass-blowers in many parts of England have a firm belief in the efficacy of garden snails as a cure for consumption. In former times the glass-workers of Newcastle held an annual snail feast, and went out in a body into the country to collect their own supplies on the Sunday before the feast day.

Photo: Stanley Crook.

Young Swallows at rest, showing the dark breast and light underparts. The throat and forehead are pale chestnut at this age.

31.—THE SWALLOW FAMILY

By A. LANDSBOROUGH THOMSON, O.B.E., D.Sc.

THREE members of the swallow family are numbered among common British birds, namely, the swallow, the house-martin, and the sand-martin, and of these we propose here to give some brief account. With them is sometimes confused the swift, an unrelated bird possessing some points of resemblance in habits and appearance, which is separately treated elsewhere.

All the three species now in question live on insects caught in the air, and have widely gaping mouths armed with very small beaks. All are birds of rapid flight, and have rather elongated bodies and long narrow wings. All of them, too, are found in this country only in summer, as their insectivorous habits would lead one to expect. They are also all gregarious and generally to be found in small colonies.

The three birds can be readily distinguished by their plumage. In the house-martin the whole of the underparts from chin to tail are white, whereas the swallow has a dark breast and a reddish throat: the house-martin has also a white patch on the rump, which is very noticeable when the birds fly low or cling to a wall. In the sand-martin the upper parts are light brown, in contrast to the glossy blue-black of the other two species. All have forked tails, but it is only in the swallow, and only in the adults at that, that the outer feathers are elongated into streamers. There are various differences in habits to be noticed, but it will be more convenient to take each species separately in its turn.

The swallow is perhaps best known as being a familiar type of summer visitants, but of its migrations we have already given some account in an earlier chapter. Here, then, it remains to consider the habits which may be observed between the dates of arrival in spring and departure in autumn.

A very great part of the swallow's time is spent on the wing in pursuit of insects, and

the birds are certainly tireless fliers. Sometimes they will circle about low down round the farm-steading where they nest or over the neighbouring fields, and the air above any water that there may be in the vicinity is always particularly favoured. At other times, depending on weather conditions, they seem to find more insects at rather higher levels. As a rule, the prey consists of quite small insects, and several are caught in the wide gape and held fast by the sticky saliva before any are actually eaten. On occasion, however, even so large an insect as a butterfly or moth is taken. Sometimes, again, swallows will not disdain to feed on the ground, and they may also be seen hovering about the heads of flowers, such as the ragwort, to pick off what insects are there to be found. In addition to the familiar twittering notes so constantly heard during flight, the swallow has a simple but pleasing song, which is usually uttered from a perch near the nest and is not audible at any great distance.

Both parents take part in the work of nest-building or nest-repairing—for the old nests are used again in succeeding seasons—and the material required is gathered partly on the ground and partly in the air. At times the birds may be seen walking daintily at the edges of puddles on the road collecting small pieces of mud; at others they may be seen skilfully catching in mid-air such hairs or straws or feathers as may be borne by the wind.

The nest is occasionally built on some ledge of rock in the shelter of a natural cave, doubtless originally the most favoured site, but in this country and in these days it is nearly always in or on a building of some kind. True to its cave-nesting instincts the swallow prefers to build in a sheltered situation, in a porch or outhouse say, but it will at times nest on the outer wall of a house under the slighter protection of the eaves. Very often the nest is supported by a rafter or by a ledge, but this is by no means indispensable; in any event, it is commonly placed against an upright surface and takes the form of "half a deep dish"; when the vertical surface is lacking the nest is completed in circular form, and in general it varies to some extent with the exigencies of the site. The nest itself is made mainly of mud, and it represents a vast amount of labour, considering the small quantities in which the material is necessarily collected and transported. The structure is strengthened by the admixture of hairs and straws, and when it is completed a comfortable lining of straws and feathers is added.

The eggs are usually from four to six in number and are of an oval shape. They are

Photo: Stanley Crook.

Solving the housing problem in small space. Two Swallows, true to their cave-nesting instincts, have joined up their nests to benefit by a sheltered situation.

Photo: J. T. Newman.

Two nearly-fledged young Swallows at the nest; below—

Photo: Albert H. Willford.

—in the sunshine, sit basking two fully-fledged young Swallows. The dark neck and breast, and the edge of the white underparts show clearly.

white in colour but with small reddish-brown and pale grey spots. Incubation—undertaken entirely by the hen, who is fed partly by her mate—takes just over a fortnight, and the young when newly hatched are blind, helpless and almost naked. More insects than ever must now be caught by the parents, and little pellets of them are brought at frequent intervals to satisfy the hunger of the growing youngsters. In a few weeks the young are fledged and look not unlike their parents in plumage, except that they lack the long streamers to the forked tail. At this stage they may be seen perching on the edge of the nest in an eager row awaiting the arrival of food. Their first flights take them to other perches such as the roof-ridges, the branches of trees or the telegraph wires, and there they continue to be fed as before. A little later and they are strong on the wing; then they are fed in the air, and it is a pretty sight to see the old bird and the young one meet and rise together while the transfer of the morsel is effected.

Soon, however, the youngsters must fend for themselves, for their parents have much work still before them—no less than the incubation of a second clutch of eggs and the rearing of another brood. Sometimes even a third brood is attempted, probably by birds which found a nest in good repair at the beginning of the season and were thus early with their original clutch. These third broods are apt to be ill-fated, for they may be deserted in the nest by their parents if they are not yet on the wing when the call to migrate will no longer brook refusal.

The martin proper or house-martin, as distinguished from the sand-martin, is a bird of the same size and general aspect as the swallow. It is to be identified, as we have said, by the large amount of white in the plumage and by the absence of the long outer tail-feathers. The ordinary note, too, is harsher.

Photo: Stanley Crook.

A House-martin's nest. It is often built almost entirely of mud, with little or no admixture of hair or straw. Yet it coheres for several years, and proves that the method of building is sound.

The migrations of the house-martin are similar to those of the swallow, but in its appearance in this country in spring it is usually a few days later. During the summer it is if anything the more widespread species of the two, because it restricts itself less closely to the haunts of man. It is a rather less well-known bird, chiefly because it is not always distinguished from its relative.

The nesting habits of the house-martin differ in certain respects from those of the swallow. The original nesting site was

Photo: Stanley Crook.

A PEEP OUT.

A young Sand-martin leaving the nesting-hole takes certain precautions before withdrawing from safety.

Photo: Stanley Crook.

The nest of the Sand-martin is made at the extreme end of the burrow. In the photograph the bank has been scraped away so as to expose the nest.

doubtless on rocky cliffs, not in caves as with the swallow but on the open face, and this site is still quite frequently used. Buildings have, nevertheless, taken the place of natural sites to a great extent, but here again there is a difference between the two birds; while the swallow, true to its cave-nesting origin, prefers to go inside a building, the martin ordinarily builds on the outer wall and merely under the shelter of the eaves.

There is a difference, too, in the nest itself. While that of the swallow is an open cup, the martin's nest is roofed over as befits its more open situation, and a small hole near the top of the structure is the only means of access.

The nest is made of mud as in the case of the swallow, but it is often of mud alone with little or no admixture of hair or straw, and it is a marvel how it coheres sufficiently well to last for several seasons with only minor repairs. Doubtless some slight irregularity in the surface of the wall or cliff is generally used as the foundation for the first piece of mud, for the nest is not definitely supported by a ledge or beam as is so often the case with the swallow's. That even no roughness is absolutely necessary, however, is shown by the remarkable instance of a pair of house-martins successfully constructing their nest against the smooth surface of a vertical pane of glass.

The eggs of the house-martin are pure white instead of being spotted, but there are no further noteworthy differences to recount between the nesting habits of the two birds. This species, it may be added, is the "martlet" of heraldic devices.

The sand-martin is a rather smaller bird than either the swallow or the house-martin, and it is also distinguished by the light brown colour of the upper parts. The flight is similar but rather more erratic, and apart from nesting, its general habits are of the same kind.

The sand-martin is appreciably earlier in its arrival here for the summer than the other two species, and it is also earlier in its departure in autumn. During the intervening period it is by no means an uncommon bird in this country, but it is rendered somewhat local in its distribution by its special preferences in the way of nesting sites. On the whole, therefore, it is the least familiar of the three.

The usual nesting site is in a bank of sand or soft soil. Sometimes the side of a sand-

pit or of a railway cutting is utilized, but a situation near water is preferred, and the escarpment of a river bank—some high sandy bluff in the angle of a bend—is the most favoured place of all. In the chosen bank, wherever it may be, the sand-martins tunnel inwards and slightly upwards for several feet, and in a chamber at the end they make a slight nest. Both sexes take part in the work, and, although the birds seem to be but feebly equipped for burrowing, the necessary excavation is not unduly long in being completed. The same holes are used in several successive years, but in the end they often have to be abandoned owing to their verminous condition. The sand-martin is a victim to various insect parasites, and has the distinction of possessing a species of flea peculiar to itself!

The nesting habits are naturally rather difficult to observe, but in the main they resemble those of the related species. As in the case of the house-martin, the eggs are pure white in colour.

In conclusion it may be remarked that it is noteworthy that three species so much alike both in structure and in habits should flourish in the same area and often in the same localities, all three being, indeed, quite commonly seen together. As a general rule each kind of bird is in some way a specialist: it holds its place in the scheme of things by exploiting particular natural opportunities and by exploiting them in a particular way. Where two are so alike that they come into competition all along the line, one is apt to survive and the other to go to the wall. The three British members of the swallow family, however, are not really exceptions to this rule. Although they are so closely similar to each other in their feeding habits, each, as we have seen, has its own peculiar manner of nesting which removes it in this respect from the sphere of competition with the others.

Photo: E. L. Taylor.

The usual nesting site of the Sand-martin is in a bank of sand or soft soil—the side of a sand-pit or a railway cutting, or preferably the escarpment of a river bank.

Photo: Capt. C. W. R. Knight.

Two castings from the Little Owl compared in size with one from the heron. Almost every Little Owl's casting contains the remains of beetles.

32.—A FLOURISHING ALIEN: THE LITTLE OWL

By CAPT. C. W. R. KNIGHT

EARLY in the spring of 1907 I experienced one of those great thrills of delight which take hold of every bird enthusiast when he comes upon the nest of some hitherto undiscovered species. April 14th, 1907, was the exact date, and the discovery of the little owl's nest was yet another instance of the manner in which the nest of some more or less rare bird may be revealed by a lucky accident.

In the first place, attention had been drawn to a particular oak tree by the incessant "chinking" of a pair of chaffinches; the unhappy birds—obviously in a state of highly strung nervous excitement—were giving vent to their feelings in their most arresting style.

Obviously something was amiss, and suspecting the presence of a stoat or barn owl I went forward with the idea of ascertaining the cause of the commotion.

When I was within some twenty feet of the tree I suddenly—instinctively—came to an abrupt standstill, for without the least warning a small brown bird—for all the world like a missel-thrush with a stumpy tail—dropped from a hole some twenty-five feet from the ground; and with spasmodic wing-beats and undulating flight swung away towards the distant elm, an excited crowd of missel-thrushes and chaffinches chattering in her wake.

Quite a few tense moments passed whilst I stood motionless; gaping after the little brown form and wondering whatever kind of bird it might be.

And then in a flash I realized that it must be none other than a little owl—"one of those little Dutch owls" such as the gamekeeper at Edenbridge had shot in the previous year.

The next step, without further delay, was to investigate the hole from which the owl had flown—not a particularly easy proposition, for although it was so comparatively near to the ground, the tree-trunk itself was quite bare of any branches that might form a convenient hand or foothold.

However, by dint of much exertion and

a pole propped against the tree, the first branch was successfully reached, and then it was possible to lean round the tree and to peer into the little owl's home.

At first, owing to the extreme darkness of the hollow, nothing of interest was discernible; in fact, the place seemed to be empty. Then some small dark objects resolved themselves into some castings, and farther back in the hole—by all that was wonderful!—were two round white shapes. The eggs of the little owl!

It seems strange that, only sixteen years ago, the discovery of a little owl's nest should have caused such feverish excitement; for in these days, at any rate in the south-eastern corner of England, one may happen upon some dozen or so little owls' nests in the course of a single season.

For the little owl, in spite of the fact that the hand of every game preserver is raised against it, has increased to an almost incredible extent, a fact that may be partly due to the Great War, when the majority of gamekeepers forsook the gun for the rifle and our friends the vermin had the time of their lives.

The spreading of the little owl is perhaps another instance of the manner in which imported creatures are liable—as it were—to outstay their welcome.

It ought perhaps to be explained here that the little owl was originally imported into this country from the Continent, and liberated in the hope that it would ultimately become established as a breeding species—a hope that has been amply fulfilled.

Photo: Capt. C. W. R. Knight.

The Little Owl was introduced into England in the hope that it would become a breeding species, and it has!—to an incredible extent.

Yet in spite of the fact that such an uproar of protest has been raised against it, the little owl, in my humble opinion, does little or no damage to game birds. Young partridges are, it is said, its favourite victims, but one ought perhaps to consider how this miniature winged hunter could contrive to capture such elusive quarry.

One must first realize the fact that parent partridges are in the habit of accompanying their family until long after they are able to fly; they are ever watchful—ever ready to sound the alarm at the moment that a bird of prey appears. The parent partridge is also an extremely game bird and would not stand idly by if one of the family should chance to fall into the clutches of this cheeky, round-faced owl, but immediately dashing to the rescue, would lay about him with both wings and feet and quickly send the miscreant about his business.

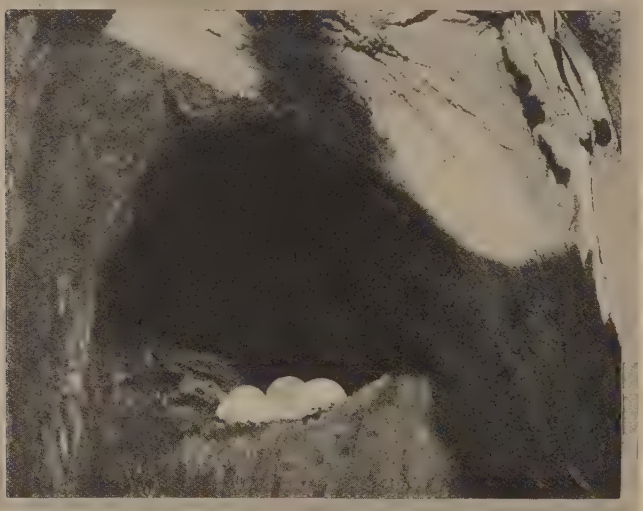


Photo: Capt. C. W. R Knight.

The Little Owl's nest is built in a hole in the trunk of a tree. Sometimes part of the nesting-hole is used as a larder.

Then there are two most reliable ways of ascertaining what a little owl has been procuring in the way of food. First, by examining the castings or pellets that will be found in and around the nesting-hole (castings, of course, being the little pellets of indigestible matter such as fur and feathers, which swallowed by the owl are ejected through the beak some hours later), and, second, by noting the food which the owl has stored in her larder.

For the little owl is a very provident bird, one, apparently, who prepares for a rainy day; and each pair have a "larder" quite close to the nest in which superfluous supplies are stored. At times the larder will be situated in some hole in the home tree some few feet away from the actual nesting-hole; at others it will be in a hole in a bank not far from the foot of the tree—perhaps a rabbit hole—or else in a hollow of some other convenient tree close by. Occasionally the little pile of food may be found in the same hole as that in which the eggs have been laid—but in a specially reserved corner.

Amongst the items comprising such "larders" I have discovered the remains of rats, water voles, mice, young rabbits, various small birds such as robins and sparrows, starlings, blackbirds, thrushes, missel-thrushes, frogs and moles, but never a sign of a young game bird—doubtless on account of the reasons suggested, and not because the owl has any respect for food that we humans are inclined to regard as our peculiar property.

The castings, too, may prove to be additionally interesting since they usually afford evidence of the owl's penchant for insect food. Almost every little owl's casting contains the remains of one or more beetles; many, indeed, are composed almost entirely of beetles' cases—perhaps held together with a little mouse's fur.

It is on account of this penchant that little owls are sometimes caught in those little tunnel traps that game-

Photo: Capt. C. W. R. Knight.

A YOUNG LITTLE OWL.

Note the swathes of down adhering to the breast and neck feathers,

Photo: E. W. Tayler.

The Little Owl in spite of his unpopularity has many redeeming features. His expression suggests that he is of a humorous disposition—a quality amply displayed by this trio of youngsters photographed near their nest in Northamptonshire.

keepers set for stoats, weasels, hedgehogs and such-like "vermin." The little owl running through the tunnels in quest of beetles happens to step on the trap—only to join, later on, the row of battered corpses that adorn the keeper's "scrag-pole."

In one way or another the little owl seems to have succeeded in making himself thoroughly unpopular; some are out for his blood because of his reputed partridge-slaying proclivities; some dislike him intensely on account of that "horrible shrieking noise" that constitutes his love-song; and others criticize him for no other apparent reason than that he is an alien—a foreigner—who has no real right to take advantage of the peaceful comfort that this country affords.

Yet in spite of his unpopularity the little owl has many redeeming features. His expression suggests that he is of a humorous disposition, and his actions tend to confirm this belief, as any who have seen him alternately squatting flat and suddenly standing bolt upright—like a jack-in-a-box—will readily agree.

He is certainly a devoted parent, who likes to know that his wife and family are amply supplied with food, and he is perhaps almost *too* confiding in mankind.

Regarding that last attribute it is interesting to observe that in order to find out how many eggs a little owl's nest contains, one must frequently, first of all, remove the sitting bird!

The fact of lifting her from her charges, of withdrawing her from the nesting-hole and giving her her liberty, seems to have not the least ill effect upon her tranquil temperament, for on the next visit to the nest she will be found sitting as serenely as before, and will remain completely unconcerned if the experiment be repeated.

I can recall a little owl's nest which for almost three weeks remained wrapped in mystery. The nesting-hole was extraordinarily low down—about two feet from the ground and about fifteen inches in depth. When it was first discovered the hollow contained four eggs, one field mouse and half a shrew; mentally noting these items, I merely supposed that the bird had not yet finished laying. Some three days later, again passing the stump, I once more looked into the owl's nesting-hole. The mouse and the shrew had been replaced by a robin and a portion of mole, and there were still only four eggs.

Now if the owl had laid her full clutch of eggs three days ago, she ought to be sitting. Obviously she had not been killed, as the fresh food testified; and yet she had never left the nesting-hole—at any rate, no one had seen her.

Then the question was raised "are the

eggs warm ?" A coat sleeve was rolled up, a hand inserted into the hole, and the answer came "yes!" "Then she must have left the stump when no one was looking."

Certainly that must be the explanation.

Later the same day a second visit was paid to the little owl's nest. This time the investigators tiptoed gently forward; neared the stump, craned silently over it, and peered into the hole, fully expecting to see the sitting bird. Yet only the four eggs shone out of the darkness.

Once again the coat sleeve was rolled up, the arm inserted and the eggs found to be quite warm. And still no sign of the owl.

This business of creeping on tiptoe to the owl's nesting place, of leaning, snake-like, over it, and of peering into its depths was repeated on each of the next successive days. Each time the eggs were warm, but never a sign of the owl.

Not until the young owls were hatching was the mystery solved; and then only because the owl allowed one of her claws to protrude from the roof of her home where she had taken refuge.

It transpired that she had squeezed herself into a small and exceedingly well-hidden crevice on a level with the entrance to the hole, a crevice that, in spite of our diligent inquiries, we had not succeeded in locating —and had remained in these confined quarters until the coast was clear once more.

The peculiarity of sitting so tightly as to allow herself to be lifted from her eggs is not altogether confined to this the smallest of the British owls, but is shared in a lesser degree by the largest of our common owls —the tawny or wood owl.

As a rule the tawny owl, like its diminutive cousin, elects to lay its eggs in a dark hollow, and in such a situation may be sometimes discovered covering the eggs or young. But when the deserted nest of a crow or magpie is appropriated, the bird seems less loth to leave her charges and is generally well on the wing by the time the climber has commenced to ascend the tree.

Photo: Capt. C. W. R. Knight.

As a rule the Tawny Owl prefers to lay its eggs in a dark hollow, but on occasion will occupy the deserted nest of a magpie—as shown in the photograph—or a crow.

The Skylark, as a parent, has a very busy time, catching insects for its nestlings. The old birds have been known to bring food to them as many as forty-seven times in an hour.

33. THE SONGSTER OF THE SKY

By HENRY WILLFORD

With photographs by the Author

THE skylark is perhaps the best-known and the most beloved of all our British wild birds. As we escape from town and go out into the country—whether it be east or west, south to the Scillies or north to the far-off Shetlands—his will surely be the first note to greet us. Trilling, rippling, sparkling, the lark-song falls upon us and about us like a fountain of pure joy. Up he goes, the tiny mottled songster, up with rapid wing-beats, rising almost perpendicularly till he is lost in the vast abyss of air. How does he stay there, a mere speck in the blue, pouring out that rich, unceasing melody? We watch and listen and wait, and perhaps see him fall at last in a lovely curve, settling close by the spot from which he first took wing.

There is nothing niggardly about the skylark. With the same wholehearted spirit that deluges the air with song, he sets about his more homely domestic duties. Early in April the first nest is built, and the first eggs—three to five in a clutch—are laid. No sooner, however, is one family fledged and sent off into the world than—sometimes even before the first is flown—the parents are preparing another nest. Several broods in the year these hard-working little people will rear, and of those that I myself have been able to watch, all, without exception, succeeded in fledging their young.

Considering the exposed situation of the nest, this is somewhat remarkable. As a rule it is built in the open, in meadow grass, on rough common-land or, indeed, any kind of ground that may be available. In the Shetlands I have found them nesting in such short grass that I could distinguish the sitting bird several yards away.

The nest is built of bents and dried grass, with a lining of finer grasses and also, occasionally, hair. The eggs are inconspicuous amidst their surroundings, being of a greyish

"MY LORD SLEEPS!"

A pair of Little Owls. The male is dozing, and shows the thick eyelids characteristic of the species

Photograph by G. Hearn

THE PHILOSOPHER

A Little Owl contemplates the camera.

Photograph by Riley Fortune, F.Z.S.

TWO DOWNY YOUNG LITTLE OWLS

Photograph by Captain H. Morrey Salmon, M.C.

THEIR FIRST SUIT OF FEATHERS

Photograph by Howard Bentham

A WISE HEAD ON YOUNG SHOULDERS

Fledgling Little Owl

Photograph by G. C. S. Ingram

brown colour, sometimes tinged with olive-green thickly speckled with brown—darker or lighter in shade.

In the photograph it will be seen that there are four eggs, three of normal size, but the fourth no bigger than a pea. This, I think, is very unusual, and is the only time I have seen such a phenomenon amongst British wild birds. It is, of course, not uncommon with domestic poultry to find a diminutive, yolkless egg ; but this is usually a pullet's first attempt at egg-making, or the last on the part of an old hen.

For thirteen or fourteen days the mother lark sits peacefully on her eggs, listening to her rapturous mate above. After that, when the chicks hatch out, her blissful life is over and she must devote herself to the urgent matter of the food-supply. The young birds grow quickly, and the amount they will eat —mainly in the form of insects—is almost incredible.

So voracious are young larks that once I thought I would count the number of times that the parents returned with food in their bills. This amounted to no fewer than forty-seven visits in one hour—the chicks being eight days old at the time !

This is the most interesting time to study the little family. They are exceedingly easy of approach, and can be watched without difficulty from a small " hide " which need not even be covered or camouflaged. It is pretty to see the nestlings running out to meet their parents as the latter return with some tempting insect. They swallow it greedily and, as the old birds fly off again, return once more to the safety of the nest.

After this youthful period on the open common, the young lark family, now fully fledged, takes up its quarters in the stubbles and varies the insect diet with wild seeds. When the autumn comes their numbers increase enormously by the immigration of northerners. A northerly gale brings these visitors over in thousands, and from now onwards a constant stream steadily passes through to the south. Some, no doubt, will return with a change of temperature, but the great bulk remain away till the early spring migration, when they again visit our shores and pass back to summer haunts in the north.

The nest of the Skylark is built of bents and dried grass with a lining of finer grass. In this nest are seen three eggs of normal size, and a fourth no bigger than a pea—a very unusual phenomenon.

In the dry weather during the spring and summer months larks may often be seen on the ground as one travels along the

dusty highways. These birds, it would appear, prefer to dust themselves in the loose sandy surface of the highway after the manner of the common barn-door fowl, rather than bathe in water. I have wondered sometimes if they use this means to destroy any insect vermin which may be hidden away among their feathers. On the whole, I do not think this can be the case, as when I have examined captured birds of this species I have found them free from all sign of such pests. Of course, many birds that spend the greater part of their time upon the wing—noticeably the swifts, martins and swallows—act as hosts to a large number of such parasites.

The male skylark is very fond of showing off to his mate while this dusting toilet is in progress. With crest erected and tail and wings spread out fanwise, he will waltz about her, and at times so engrossed is he in this love-making that he will fly up only just in time to avoid being run down by the fast and silent-tyred traffic.

Although for the most part the skylark sings while apparently suspended in mid-air, yet he is quite capable of, and is not averse to, singing on the ground or, in the manner of the corn bunting, perched on a post or rail.

Though he can be heard in all parts of the country, yet the lark seems to prefer open spaces, and especially cultivated lands.

As a rule, the nest of the Skylark is built in the open among meadow grass or on rough common-land. This photograph shows one in a well-covered situation.

In winter he sings whenever the sun shines, and in spring and summer his is the first voice to greet the dawn, while then in cloud or shine, endlessly it seems, his song pours from the sky. Yet it is not a song of which one tires; the monotonous note of the cuckoo, and even the persistent repetitions of the thrush, may exasperate after a while, but the lark's song, though it goes on all the time, is never obtrusive—almost one can hear it, or not, at will.

In colouring, the difference between male and female is very slight. The hen is a little smaller, but both are reddish brown on back, wing and tail coverts, each feather

being bordered with a paler tint. The under parts are light, and the throat and breast spotted with dark brown. They both bear a feathered crest which can be erected at will, and this gives the little bird its characteristic look of alertness—and distinguishes it, too, from its cousin the meadow pipit.

Speaking of the meadow pipit, it is a curious fact that this bird, whose nest, in build and situation, is almost identical with that of the skylark, should be so often victimized by the cuckoo, while the latter is left alone. During the last ten or eleven years, searching over the same bit of rough common-land, I have found eighteen nests of the meadow pipit containing an egg or young bird of the cuckoo, whilst out of the scores of larks' nests that I have come upon not one had been visited by that bold bird-parasite. Why this should be so is entirely unexplained.

To lovers of wild life it is a horrifying thought that so free a bird as the skylark—revelling as it does in open spaces, climbing in its ecstasy to the very doors of heaven—should ever be confined behind the bars of a cage. Yet in the north of England there must be thousands beating out their lives in confinement—singing even in the back streets and slums of manufacturing towns. Thousands are trapped or netted every year by the professional bird-catcher. They are captured not only for their song—a purpose which might conceivably be advocated when one considers the dearth of beauty in the lives of so many town-dwellers—but also to tickle the palate of the epicure and provide appetizing dishes for the already overfed. This slaughter is carried out far more relentlessly on the Continent than it is, fortunately, at home. In Italy every available feathered creature is shot or trapped for the pot, and the " chasseur " or sportsman with dog and gun may be seen amid the olive groves, stalking even such homely small-fry as the linnet!

It would be a sad state of things if the bird-life of our own country were to suffer such depredations. Mercifully, public opinion is increasingly on the side of its preservation; and with public opinion, backed by legislation, and the efforts of private individuals thrown into the scale, we may even now hope to stem the ravages, not only of the money-maker and the irresponsible amateur, but of the " collector " as well, whose persistency and greed are probably responsible for the extermination of many of our rarer species. A British landscape denuded of birds is unthinkable.

Young Skylarks are voracious eaters, and as soon as they are able will run from the nest to meet the parent birds when they bring food.

34.—VARIATION OF THE NESTING HABITS OF THE RINGED PLOVER

By C. W. COLTHRUP, Z.P.C.

With photographs by the Author

THE study of the variation in the nesting habits of our native birds opens up an interesting subject for record work, not only of the sites and materials chosen, but also the actions of the birds when at the nest.

I have found the ringed plover a most fascinating species to work, and, indeed, most of the ground nesting birds afford good material for systematic study. I think the most extraordinary case was that in which a ringed plover made a nest of pebbles and laid her eggs between some railway lines. The pebbles of which the nest was composed must have been carried some distance, as they were perfectly clean, whereas those between the lines and on each side of them were dirty.

Nest of the Ringed Plover between railway lines. This curious nesting site, on which were laid four eggs, was composed of clean pebbles, which must have been carried some distance.

One wonders what induced the bird to lay its eggs in such a position, as there was ample shingle on each side of the track. A number of trains passed over the nest during the day, and the bird could be seen leaving the eggs when the train was only a dozen yards away.

Three of the eggs were safely hatched, the fourth, which was only one and a half inches from the rail, got cracked.

It is rather a difficult matter to assign a reason for this variation in the nest-building instinct. At one time I was inclined to the idea that the collected pebbles were for the purpose of raising the eggs from the damp earth or sand, and that where the eggs were laid on large stones on a beach a "nest" was not necessary as the rain quickly drained off.

I have, however, found nests which consisted of a hollow scooped out in the sand among small shingle (p. 693), in some cases bare, and in others lined with small stones, whereas one would have thought the surrounding shingle would have afforded an excellent place whereon to deposit the eggs.

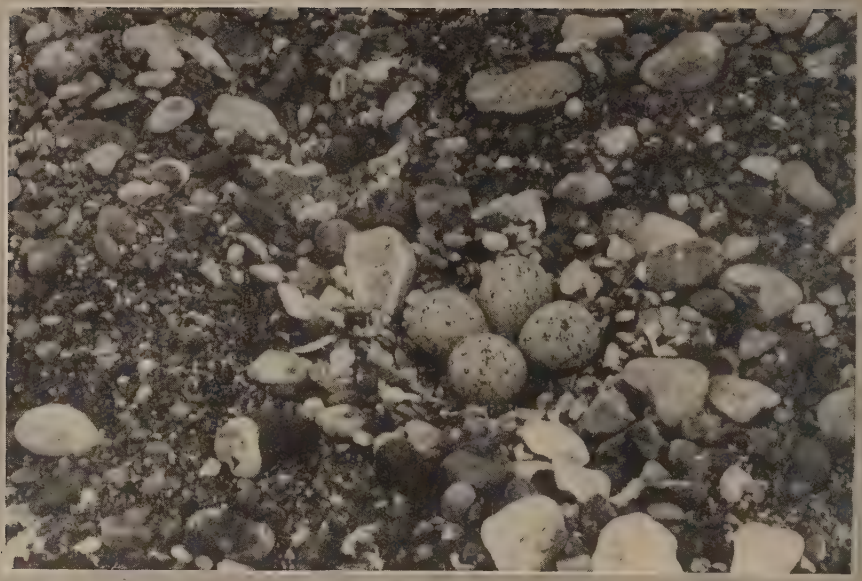
On another occasion I found eggs deposited on bare sand amongst stones, without any attempt at scooping out a hollow. In the former case we have a bird showing the nest-building instinct, and in the latter the apparent absence of it. The photograph on p. 697 shows eggs laid on bare earth in a rabbit warren, and that on p. 696 eggs laid on a mudflat. The same nest is shown with the eggs removed, and it can be seen that the nest is lined with mudflakes.

I have frequently found the eggs laid on grey seaweed left by the high tides of winter, and once or twice on bare sand among marram grass, as though to ensure a certain amount of concealment. In another case I found a nest composed of small sticks and broken pieces of dried stems of a plant growing among the shingle, probably dock or ragwort. The two photographs on p. 694 show a very fine example of

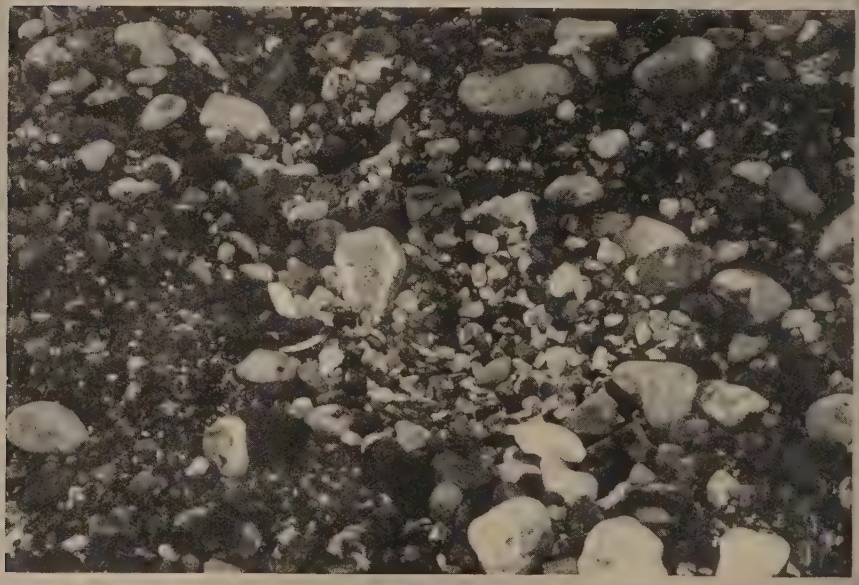
Ringed Plover on a nest among shingle.

nest building, and I have always regretted that I did not count the number of pebbles collected. It has been recorded by Commander Lynes (" British Birds," Vol. 2) that he found a nest in a rather deep hoof-mark of a cow in sun-baked mud near Portsmouth.

The Ringed Plover will sometimes merely scoop a hollow in the sand amongst shingle for the purpose of a nest.



Nest and eggs of the Ringed Plover made amongst shingle and carefully lined with pebbles.



This photograph of the above nest with the eggs removed reveals the trouble to which the birds must have gone in collecting and arranging the pebbles.

Ringed Plover's eggs on the beach are difficult to see at close range; at a distance the difficulty is increased. They are in a line with the arrow.

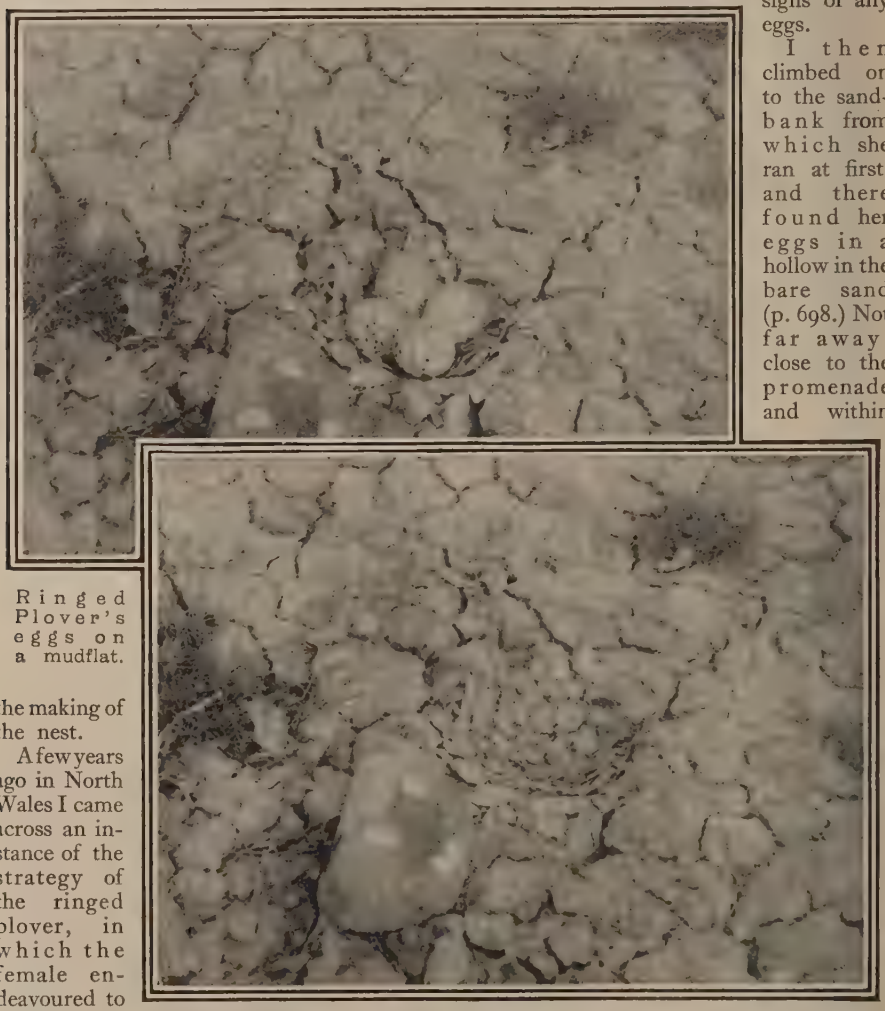
Young Ringed Plover just hatched out in the nest on the beach. In this and its companion picture, in which three Ringed Plover chicks are to be seen, it will be realized how successful is the camouflage of the plumage.

It was composed of small pebbles, which numbered 2,000, weighing seven ounces, and must have been collected from a distance of twenty yards. Col. Feilden has recorded the use of green fleshy leaves in the making of the nest.

A few years ago in North Wales I came across an instance of the strategy of the ringed plover, in which the female endeavoured to draw my attention from her eggs. When some 200 yards away I saw the bird run down from a fifteen-foot sand-bank to a small patch of stones and nestle down as though settling on eggs, where I could see her plainly through my glasses. She stayed until I was within about a dozen yards of her and then flew to the water-side.

I examined the stones from which she flew—just the kind of pebble patch one would expect her to choose—but there were no signs of any eggs.

I then climbed on to the sand-bank from which she ran at first, and there found her eggs in a hollow in the bare sand (p. 698.) Not far away, close to the promenade and within twelve yards of a seat used by visitors, I found another nest containing four eggs; the lining of the nest consisted of small fragments of stone. In the former case the female showed unmistakable signs of the instinct to lay its eggs and brood



Ringed Plover's eggs on a mudflat.

With the eggs removed the "nest" is seen lined with mudflakes.

Nest of Ringed Plover composed almost entirely of shells.

among the pebbles, yet it chose the bare sand. The top photograph on this page shows a nest composed almost entirely of shells.

In the illustration on p. 700, photographed in the south, the bird has gone out of its way to lay its eggs in the middle of a small patch of stones on rough grass-land.

The behaviour of these birds when one is near their nest also varies. I have known a bird leave her eggs (which were well incubated), fly right out of sight, and not put in an appearance until I was well away from them again. At another time, when a nest only contained one freshly laid egg, the bird came to within a few feet of me, and showed the utmost concern, and by its broken wing antics endeavoured to draw me away from its nest.

On one occasion I found a nest, and while I was putting up my tent, both birds came within a few yards of me and squatted on the shingle. I deluded myself into thinking that I was going to have an easy time photographing them, as both of them tripped daintily over the pebbles to within ten feet of where I stood, the male every now and again sinking into a slight hollow in the shingle, pretending to be sitting on eggs, while the female lay on one side flapping a wing and holding it up as though wounded, in true plover fashion.

Had I followed them they would have jumped up, run a little farther and repeated the performance again and again, until they had drawn me away from their eggs. I entered my tent and commenced what turned out to be a long wait. Both birds pattered about, ten feet away, the male trying to drive the female on to the eggs, but she did not summon up courage to do so until I had lain in a cramped position for over an hour.

When she finally settled on the eggs, she seemed very nervous and inclined not to stay, so I pressed the bulb, when she jumped into the air as though shot, and flew off. Though I waited another hour and three-quarters she did not return to the nest.

With other members of the species I

Eggs of Ringed Plover laid on bare earth in a rabbit warren.

Nest and eggs of Ringed Plover in a hollow in the sand.

have had the greatest difficulty in getting the female to leave the eggs in order to get a photograph of her approaching the eggs. On one occasion, I shouted, waved a hand out of the tent, and finally a handkerchief, all to no purpose, the bird sat tight. Fortunately, a friend who was in hiding at a distance recognized it as a signal, and came up, thus driving the bird off. This had to be repeated every time I made an exposure.

When one is at a nest containing eggs that are fairly well incubated, the male stands a short distance away uttering a piping note, while the female flies round in circles uttering rather mournful though musical notes in quick succession, which sound like *wit-a-wee*, *wit-a-wee*, *wit-a-wee*. These notes are varied by more guttural notes which sound like *what-a-pity*, *what-a-pity*, *what-a-pity*, and *puwit'*, *puwit'*, *puwit'*, uttered continuously, the while she zigzags about, with one wing pointing to the earth and the other to the sky, showing its back and then reversing the position and revealing its underparts, all the while exhibiting great agitation. On one occasion, knowing that I was near young by their squeaking, I retired to a distance and lay down to watch events. All was quiet for a few minutes, then I heard a low piping whistle to my left and discovered the male watching me about thirty yards away. He kept up the piping whistle for a while, and as I showed no sign of moving, gave a soft whistle, whereupon the female immediately started to run away from my direction.

I thought I would try what moving an arm would do, when the male gave a loud piping warning note, and the female immediately squatted down on the shingle.

When all was still again the male repeated the soft whistle, and the female started running again, and by the aid of my glasses I could see three little fluffy balls running after her and disappearing round a small bank of shingle.

Although the ringed plover is one of the commonest shore birds, it is at the same time one of the most fascinating to watch as it runs daintily over the shingle, or stands jerking its head in the manner

Photo: G. A. Booth.

RINGED PLOVER SITTING DOWN ON ITS EGGS.

One of the commonest shore-birds, it is also one of the easiest to approach for observation purposes.

common to a number of members of this family. I have never been able to discover the reason for this strange habit.

Some members of the species lay their eggs at the end of April; these I take to be non-migratory birds which have spent the winter with us.

As will be seen by the illustrations, the eggs vary considerably. Some have a rich fawn ground colour, while others are a pale stone colour, almost white. Some eggs are covered with minute spots, others have large black blotches. Four eggs is the usual number in a nest, but on one occasion I found a nest containing five, obviously laid by the same bird, as they were so much alike. This is a variation occasionally indulged in by quite a number of members of this family.

On page 695 is a rather remarkable variety in which two of the eggs have the markings collected together in a dark zone at the top, while the other two eggs are normal. These eggs were on the point of hatching, and the photograph below shows the eggs as they appeared at five o'clock in the morning with one young hatched.

In the distant view of the eggs on the same page the four eggs may be seen not quite three-quarters of an inch from the top, and equidistant from the sides of the photograph.

It is remarkable that among the great number of nests I have examined I have never yet found a nest with more than three young, pointing to the fact that the fourth egg was addled.

Mr. Kearton in one of his books illustrates a nest of young ringed plover, and in this case also there are only three.

Eggs of Ringed Plover laid amidst a small patch of stones on rough grass-land.

Photo: M. Best.

On the rock sit four Cormorants. Every now and then, one leaning forward stretches his neck right out in front of him, and the length of that wonderful neck can then be realized.

35.—HOW THE CORMORANT GOES A-HUNTING

By DR. FRANCIS WARD, F.Z.S.

WHAT can you see at the seaside when you go away for your summer holiday? You can see all that you see in Piccadilly and in the Strand, and a great deal more—seabirds, fish, crustacean life, and thousands of other wonders of Nature. These you cannot see in town, so cut out Piccadilly and learn of these other things, and thus make your summer holiday a real change.

Sitting on the hard seat on the "front," or with your legs dangling over the cliff, you can see a small rock about half a mile out to sea—whitened at the top where the cormorants sit when they arrive to fish in the bay. The lower half of this rock is darker than the rest, for it is low tide and the sea-weed is clinging to it and also floating in the water around.

On this rock sit four cormorants—occasionally they preen themselves. Every now and then, one leaning forward stretches his neck right out in front of him; then it is that you can realize the length of that wonderful neck; a quick flap or two and he again settles down to keep quite still.

They look like black evil spirits, and evil spirits they certainly are, for they destroy an incalculable amount of edible fish, both in the sea and on inland waters. But they only appear black in the distance when seen as silhouettes against the sky or shimmering sea, for the plumage is really of a greenish-purple metallic hue, the throat is white and the coverts of the wings are bronze-brown with blackish-green markings. These markings suggest the ripples on the sea as the birds swim around.

After a time one bird flies away, straight off the rock; in his flight he just skims the

Photo: Henry Willford.

A SENTINEL CORMORANT.

His three companions have left the rock. After a time he joins them in their fishing.

Photo: Dr. Francis Ward, F.Z.S.

When the Cormorant swims on the surface he carries his head well up and forward on his outstretched neck.

sea to alight with a tremendous splash in the water of the shallow bay. It is not long before the others follow, but one still remains as if acting as a sentinel. At last he joins them, for they have gone to fish. The rock is merely the starting place for the fishing ground, for these cormorants, with others, inhabit a rocky island with high cliffs, ten miles out to sea.

In the bay the birds all fish separately; sometimes two may keep together, but usually they fish alone.

Let us watch the fishing methods of the latest arrival; one method, as shown in the three illustrations (p. 709) cut from cinematograph film, is as follows: He has gone right inshore and is swimming by a rock not a hundred yards from the beach. Suddenly his head goes under water with a splash, and in this position he continues to swim. Up again comes the head and he has a good look around to find out if the coast is clear—then down again to see if he can detect a fish. Ducking the head has the effect of cutting off reflection from the surface so as to enable him to look into the depths, and in this way he is using the same principle as when a man uses a sea telescope. Yes, there is a codling, the cormorant has caught a flash from the body as the fish turned; the bird tips up, and then there is a chase. After several seconds the cormorant reappears some forty to fifty yards away with a fish of a pound or more across his bill. The chase has been round and round, for if he had gone straight, by the time he was down that cormorant would have reappeared a hundred yards away. If you have a party together it is quite a game, when the bird has gone down, to see who is the first to spot where he comes up. The codling is now turned round, the bird raises himself in the water, extends his neck upwards, inflates his gullet, and with jerky movements the fish goes down head first.

At other times the cormorant does not

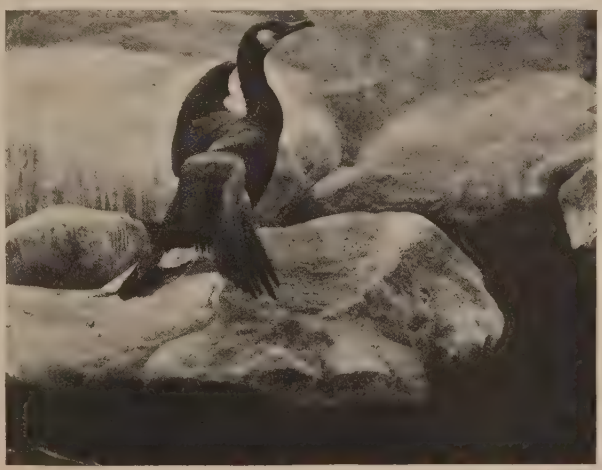


Photo: Dr. Francis Ward, F.Z.S.

The Cormorant flaps his wings to help drive down the food remaining in the gullet—a little digestive exercise.

Photo: Dr. Francis Ward, F.Z.S.

In this under-water photograph of the Cormorant it will be seen how curiously his head "flashes" when below the surface.

trouble to spot his fish from above but goes straight under, hoping to come across his prey. For reasons to be given later, in my opinion this is not nearly so successful a method.

In wild parts the cormorant, as often as not, swims ashore with his prize; this is generally where he has come across a shoal of smaller food and is full up from the gizzard to his beak, with the tail of the last capture still sticking out. When a cormorant is empty he stands erect; when full-up, like the one mentioned, he leans forward to relax the muscles over his huge meal and he throws forward his wings to do the same.

As the food is digested in the gizzard he flaps his wings to help drive down the remaining food from the gullet. This meal digested, he returns to repeat the process.

In the evening the cormorants do not return to the little rock but fly back to their rock-bound island at sea.

The cormorant is by no means fishing all the day; on the contrary, he spends a great deal of his time sitting on a rock or floating on the water, and it seems strange that with so little exertion this bird, that only weighs six to seven lbs., can catch and digest fifteen to sixteen pounds' weight of fish a day. A big fish or two certainly soon brings up the weight—and a cormorant can take big fish. I will give three authentic instances. The first bird contained a conger eel two feet six inches in length, the second a grilse weighing three pounds two ounces, and a third a trout weighing two pounds four ounces.

No, the reason why I think cormorants can so easily catch their fish is because of the method they employ of ducking the head to look under water.

From various writings in THE PAGEANT OF NATURE and elsewhere, I think it is made clear that fish, bird and beast when under the water are concealed and revealed, *when seen from under the water*, by reflection.

Observe how the cormorant reflects under water. His body does not stand out an intense dark object; there is a shining

streak on his back as it catches the light above. His head flashes silvery white as he twists it to catch a herring, while the silvery herring appears dark as it is turned towards the darkness below.

You may have seen in the third number of THE PAGEANT OF NATURE an article by myself entitled—"Expressive Attitudes in Fish." Here I show how the attention of the predatory pike is arrested by the flash from some of a shoal of small dace. In the upper waters of the sea shoals of small surface-swimming fishes often pass, and the flashes from these draw up the predatory fish in the sea. They take their toll and then retire to digest the meal.

This accomplished, the bass, pollack, and codling now wait for another flash—which means more food. Look at the third illustration of the kinematograph pictures on page 709, where the cormorant is ducking his head under water. You will notice in the lower illustration how the head of the same bird appears when seen from below the water. That portion of the body of the bird seen from below reflects his surroundings because his body above water cuts off the top light, but his head flashes.

Says the pollack on the watch, "The flash of a surface-swimming fish," and up he comes. The cormorant sees him coming, instantly draws his legs up under his breast, expands his large webbed feet, tips up and, when under water, with his feet gives one powerful stroke; as he disappears he leaves a swirl on the surface. In my under-water chambers I have often seen the cormorant go off to chase, and he gets away quickly; there is never any delay at the starting post.

Photo: Dr. Francis Ward, F.Z.S.

The Cormorant has just caught a herring. Note that his body does not stand out an intense dark object: there is a shining streak on his back and his head flashes silvery white, while the silvery herring appears dark.

Then the chase—and a good chase too—as the cormorant, swimming entirely with his large webbed feet, follows his prey. Now through a mass of weed with, on the other side a rock into which the cormorant rushed and nearly brained himself; he had lost his fish, but in his endeavours to escape the pollack turned and gave a flash, so the cormorant was on his prey again. It was

Photo: Dr. Francis Ward, F.Z.S.

Shoal of surface-swimming fishes, to illustrate the flash which draws up the predatory fish from below.

a great chase, but at last the fish was driven to the bottom and the bird seized him by the middle. The chase had been at such a pace that the cormorant had suddenly to check himself or overshoot the mark; so the bird back-pedalled with his powerful feet, and expanded the elevated pinnæ of his fourteen-feathered tail. Then our cormorant retired with his fish.

With regard to the flash from the cormorant's head when he is swimming on the water, I do not suggest that he puts his head under water in order to flash; he does so merely to see below the surface, and for the reasons given he incidentally attracts the prey to himself. The reason why cormorants kill more fish by this means than by indiscriminate hunting, in my opinion, is this. By the first method the bird has drawn his prey right up to him and the chase starts at once; whereas he may have to hunt some time under water before he finds fish, and he can only stay down a certain time—I have counted forty seconds. If a lot of this time be wasted before the chase begins, the cormorant may have to come up before the chase is over, and the fish wins.

Just one more thought before we leave the question of the flash. Fish swimming under water do not flash, as I have explained in a previous number of this publication, because of the compensating colour cells in the skin of their back; but the cormorant does. The illustration of a fishing cormorant (p. 708) streaking across the picture shows this clearly, and pollack or bass might very well be attracted by the flash to this and so drawn to their doom.

There are two birds, very similar, round our shores—the cormorant and the shag.

Photo: G. A. Booth.

CORMORANTS AT THEIR NESTING HAUNTS.

In the evening the Cormorants do not return to the little rock by the shore, but flight back to their rock-bound island at sea.

The former is known as the black cormorant, and the latter as the green cormorant. Their habits are very similar. I have already described the general appearance of the black cormorant, with the exception he has only twelve large feathers in his tail.

Cormorants and shags often sit together on the same rock. One is easily recognized from the other by the difference of size or,

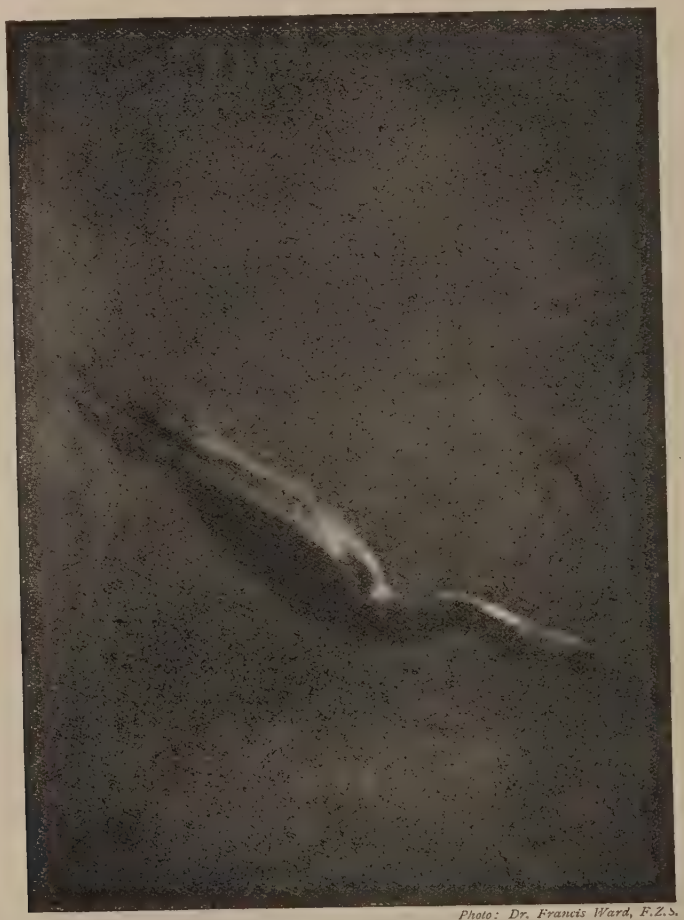


Photo: Dr. Francis Ward, F.Z.S.

The Cormorant on the chase in dark water. Perhaps the fish are attracted to the bird by the "flash" from the black, glossy lustre of its plumage.

of one feature, that in the breeding season a white patch appears on the thighs. He is the larger bird of the two. The shag is considerably smaller, and the dark plumage is green; there is no white on this bird at any time. But at the breeding time a dark green crescent develops on the head, the feathers of which are curved forwards, and through glasses, by the presence or absence of the white patch on the breast.

There is also a difference in the way in which the two birds will leave the rock. The cormorant is very timid, and when a boat is still two or three hundred yards away he will leave it, and after a long low flight will splash into the water.

The shag, on the other hand, remains considerably longer, then drops straight down into the sea with a tremendous splash, swims a few yards, then disappears below the surface with scarce a ripple. In fact, the two birds reverse the order of the splash.

The actual distance that a cormorant can travel under the water without coming to the surface is variously given as from seventy to one hundred and twenty yards. Personally, I consider the shorter distance nearer the mark.

As the bird does not stay under the water more than a few seconds it will be seen that it travels at no mean rate even if it were to swim straight forward. But the cormorant very seldom does this; as a rule it twists and turns this way and that in its search for fish.

Though the cormorant undoubtedly takes a large number of edible fish in the sea, it is when the bird visits inland waters and rivers that it becomes really harmful, for then it may safely be said its destruction of fish amounts to the value of several pounds a day. If unmolested, a few cormorants will very soon ruin any fresh-water fishing.

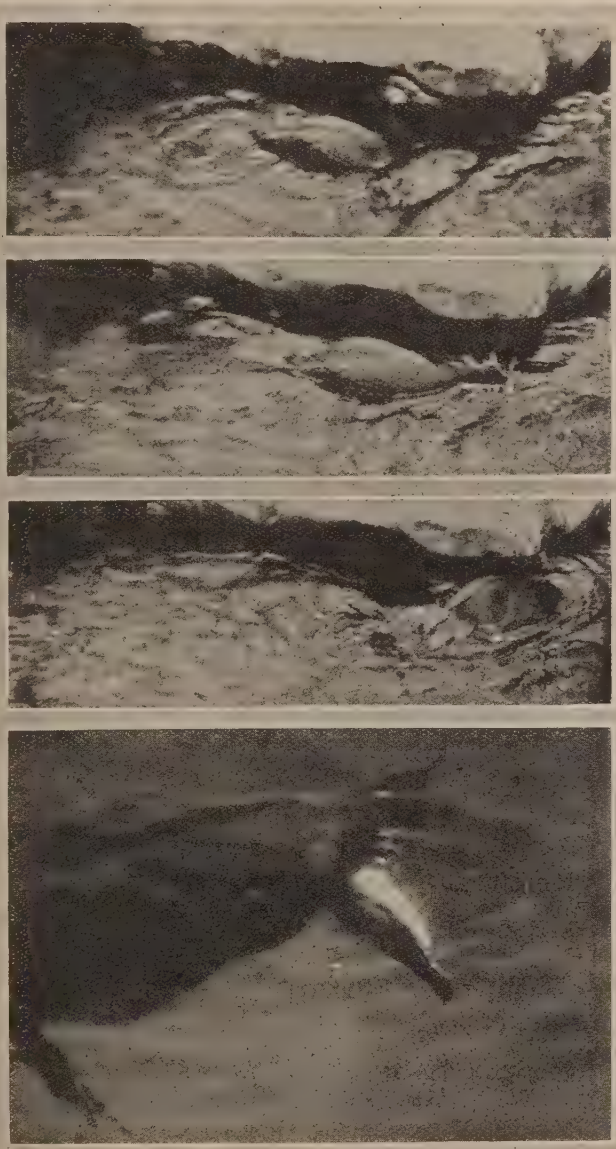


Photo: Dr. Francis Ward, F.Z.S.

A Cormorant film record. 1. Swimming on the surface. 2. The bird dips his head. 3. After raising his head, he again dips until he finds a fish. 4. In this position he "flashes" as explained on p. 704 and as shown by this photograph, which was taken under the water.

A typical Alder thicket, with reeds and sedges in the foreground.

6.—THE TREE OF THE WATERY PLACE: THE ALDER *(ALNUS GLUTINOSA)*

By G. CLARKE NUTTALL, B.Sc.

With photographs by the Author

IT is perhaps because the alder is a greater lover of watery and boggy places than is the average man that it is known comparatively little by him, for it is by no means uncommon—given suitable situations. It is the tree of the marsh and the swamp and the stream-side; no other English tree loves the water quite as much as it does, not even the willows, though they are often associated with it, particularly the grey and the goat species. Its very name, *Alnus*, is supposed to be derived from the Latin *alor amne*—"I am nourished by the stream." A quaint legend dating from mythological days is that the alder and the willow—

"Were two poor men who by their fishing lived
Till on a day when Pale's feast was held,
And all the town with pious mirth was filled,
This impious pair alone her rites despised;
Pursued their care till she their crime chastised,
While from the banks they gazed upon the flood,
The angry goddess fixed them where they stood,
Transformed to sets and just example made
To such as slight devotion to their trade.
At length, well watered by the bounteous stream,
They gained a root and spreading trees became."

The alder may be a tall tree, seventy to eighty feet high, though it is usually considerably less; it has a straight, somewhat thin trunk running right up through the crown of foliage, and it is covered with a furrowed bark which becomes scaly and dark with age. This bark was at one time much used for tanning and dyeing, a red colour being obtained from it, and a book written a century ago states that the Laplanders used to chew it and dye their garments red with the saliva. This quality of coloration was noted by Richard Jefferies as he watched alder poles being cut down by the water and peeled, for, said he, "the sap under the bark as it dried turned as red as if stained."

The wood is soft and easily splits in the fresh state. Occasionally in the country one may come across men who have felled an alder and are cutting up its wood into small oblong chunks, which lie in great heaps by the roadside. These chunks are each destined to make one of those wooden clogs in which the mill-hands of Lancashire delight, and for which this wood is peculiarly suitable, but the supply of alder for this purpose seems to be running somewhat short and birch wood is sometimes substituted for it. Alder is also used for making cigar-boxes and for cooperage.

The bole of the Alder is rather thin in proportion to its height. It is covered with a dark furrowed bark.

One cannot say that the alder is a cheerful tree: its foliage tends to be dark and rather gloomy and there is no redeeming colour about either flower or fruit. The leaves are more or less pear-shaped, and instead of ending in a point, like other leaves, they end with a notch, a peculiarity that makes them recognizable at once. The face of the leaf is smooth with parallel veins running off from the midrib, and at the back are often tiny tufts of hairs known as "felt galls," which are caused by minute mites that live and breed among them. Whether the mites do any good to the tree in return for this hospitality is open to question, but it is sometimes suggested that they act as police to keep off the spores of harmful fungi. In the bud the leaves are folded up like fans, and they are coated with gum to keep them perfectly dry. All through their life they are clammy and sticky, and it is this characteristic that gives the tree its specific name *glutinosa*. No doubt, too, it is this quality that made folks of old attribute certain virtues to them. For instance, John Evelyn, in the time of Charles II, wrote: "The fresh *leaves* alone applied to the naked *soal* of the Foot, infinitely refresh the susbated Travellor." Whether or no a Weary Willie of to-day can be classed grandly as "a susbated Travellor," and, if so, if he applies alder leaves with faith and success to his horny feet, is a matter for

speculation. Another old writer, apparently speaking from unhappy experiences, asserts that " the said leaves gathered while the morning dew is upon them, and brought into a chamber troubled with fleas, will gather them thereunto, which being suddenly cast out, will rid the chamber of those troublesome bedfellows."

The unfolding of the Alder buds in the spring. The leaves are pleated like fans, and gradually open out.

Still another use has been found for them by peasants in the Alps, who used to cure themselves of rheumatic troubles by lying under bags full of heated alder leaves, while decoctions made from them were generally employed as remedies for all manner of ulcers and inflammations. Nowadays the medicinal merits of alder leaves, as of many other leaves, are under a cloud. It may just be noted that they are arranged in spirals on the branches, three being placed on each complete turn of the spiral.

An alder twig in the very early springtime is an extremely interesting thing. If one be broken off and looked into closely, there may be found no fewer than five different sorts of objects upon it.* Most prominent are long drooping catkins swaying delicately on their stalks with every breath of wind. These consist each of a long axis round which winds, in a close spiral, a series of small, scalloped brown scales, perhaps some fifty or sixty in all. On the underside of each scale will be found twelve tiny stamens with dark heads (botanists say these represent three male flowers of four stamens each), and out of the stamen heads the wind in due course blows the fertilizing pollen. These long drooping catkins, then, are the male catkins.

Leaves, and fruiting catkins (as yet unopened) in the autumn.

Near the male catkins are much smaller objects—the female catkins. A lens shows that they are built up of rough overlapping crimson scales from between which minute

* An illustration of such a twig was given on p. 421 of THE PAGEANT OF NATURE.

tongues are projecting. Each scale has two ovaries upon it, and each ovary puts out two tongues in the hope of catching a grain or two from the pollen cloud which will pass over them from the dangling male catkins. At this point an old adage that says, " Where doctors differ, who shall then decide ? " comes forcibly to mind. For one most learned botanist states that the male catkins are mature before the female on the same tree ; a second, equally learned, asserts that it is the females that mature first (and hence in both these cases fertilization must always be from one tree to another) ; while a third professor, no whit inferior, declares that both are mature together (and hence that male catkins can fertilize the adjacent female). It is quite possible that the alder pleases itself according to circumstance, and that there is no rule in the matter.

The third kind of object found on our twig are round dry cone-like things the size of a filbert. These are those female catkins of the year before, in their fruiting stage, which did not open in the previous November, and in them the fruits are locked until one spring day when, under the sun's stimulation, the scales separate and on each can be seen lying two flat little fruits. They have no wings, as have the pine seeds, nevertheless the wind hustles them off their beds and scatters them abroad. Then, since their parent is " the tree of the watery place," some of them, at any rate, fall into the water and one sees at once that if they are not airmen they are swimmers, and specially made to float away on the stream, or in the pool, for they are fitted with air-tight cavities, like bladders, and they are coated with oil so that they are dry and unharmed however long their swim. Therefore the fourth kind of object on our twig are these female " cones " with yawning scales which have lost the seeds they produced.

The fifth kind of structure that we find in these very early spring days are little blunt reddish buds—the as yet unopened leaf buds, which have the almost unique experience among tree buds of being each furnished with a short stalk that lifts it from its bracket. This peculiarity can be better seen in the last photograph. All other buds are set right down on their brackets, so that an alder twig, even if bearing leaf buds alone, can always be known at sight.

When we turn to follow the fortunes of the little swimmers that started so gaily on their travels to find a home, we find that luck is, on the whole, considerably against them. Not more than one-third of

Female catkins of the Alder (magnified) showing the overlapping scales, with the projecting tongues from the ovaries, waiting to catch pollen grains wafted from the male catkins.

them, at best, possess the power of germinating, and of these very, very few are swept by the water into some nook where it is possible for them to establish a habitation, and this in spite of the fact that they are very minute and light—it takes no fewer than a quarter of a million of them to weigh a pound ! And when they have the power of germination they only retain it for a year. But the lucky ones, the units among the millions, once started, grow vigorously, their chief demand being for light and moisture. The little root quickly presents a knotted appearance, which is due to the presence of micro-organisms which make their home within these swellings. As these organisms have the power of taking

A BEAUTIFUL ALDER BY A STREAM-SIDE.

From the overhanging branches the fruits fall into the stream. Being fitted with air-bladders and coated with gum, they swim long distances unharmed. The Alder aims at dispersing its seeds by water transport.

THE ALDER IN WINTER.

Its trunk is tall and rather thin, and runs nearly up to the top of the tree.

The long, drooping male catkins of the Alder.

in free nitrogen from the air, a power not possessed by any green plant such as the alder, they are able to hand on to the tree nitrogenous food in return for the hospitality and support they receive. The same sort of nodules are found on the oak, the beech, and many other trees. The stem of the infant alder first carries two rather fleshy plain oval leaves—seed leaves; after these follow, singly, small leaves with saw-like edges, and with these it is well started. It may be considered quite grown up when it is thirty years old, and its course run at one hundred and fifty years. Its nearest relative is the birch, and the family name is *Betulaceæ*.

The Anglo-Saxon name was "*Alr*," from which "alder" is derived; and a number of places have received their name from their association with the tree, such as Allerton, the town of the alder; Allerbeck; Allerlie; Aldgate and Aldersgate. The Gaelic name was *fearn*, and so we have also Glenfarne, the glen of the alder, and Balfern. It is said that the city of Ravenna is built upon alder piles, and so is the famous Rialto Bridge at Venice. Evelyn makes the assertion that excepting Noah's Ark the first vessels we read of were made of this wood.

Certain varieties of the common alder are occasionally found, several being of the "cut-leaved" type, where the leaves are divided into smaller or larger lobes. Of one of these—*Var. laciniata*—there is a well-known specimen at Syon House. by

The winter buds of the Alder are unique in being stalked upon their brackets.

Kew, which was mentioned by Loudon over seventy years ago. It is now more than 70 feet in height and 11 feet in girth.

The Fairyland of Nature

Pages for the Children

By OLIVE HOCKIN

Photo: E. Step, F.L.S.

IX.—Away to the Downs

"IN a month we are going to the sea! In a month we are going to the sea!" Boodles, sitting on the garden gate, was crooning to himself, making a little song of the words, and singing them over and over again.

"It's not a month," said Topsy, overhearing him. "It's to-morrow week we are going!"

"Well, you need not say it so loud!" said Boodles. "Don't you see I am trying to make the time go quicker? If I pretend it's a whole month ahead, then a week goes like nothing. But if I think it's a week, it seems as if the seven days will *never* go!"

"*What* a silly idea!" said Topsy.

"It does make the time seem shorter, somehow," Boodles began, but he was interrupted by Popsi, who was listening over the hedge.

"I know the best way of all to make the time go!" she cried. "And that is to go up on the downs where we can see the sea! Then we shall feel as if we were half-way there."

"Hooray!" said Boodles. "Let's do that!"

Topsy ran in to ask leave, and very soon, with a basket of food, they set off.

It was a long, long way up to the downs. The old farmhouse

in which they lived was in a valley, on heavy land where grass grew thick and very green, and great oak trees studded the hedgerows. Higher up the soil was light and sandy, and there the pine trees grew, with heather and gorse and broom. But beyond the next valley the land changed altogether. There the great slopes ran from valley to sky-line without a hedge, and at the foot of the down a cutting showed that the whole hill was made of chalk.

The children loved these wide-open spaces, and they loved especially all the different flowers and trees that grew on the chalk. Even the butterflies seemed different; little blues were flitting everywhere, and black and red burnet moths and the brown and orange tiger. And as for the larks! They thought they had never heard so many before.

"How *sweet* the turf smells!" said Topsy, throwing herself down, out of breath with her climb. "Look! here are little milkworts—blue and white and pink; we never see them at home!"

"It's the wild thyme that smells so lovely!" said Popsi, sniffing.

"We'll *never* see the sea if you don't come on!" said Boodles, trudging by.

So they went on again, up the warm slopes, and then through an old chalk quarry where trees and bushes nestled out of the wind.

"I *wish* I knew what they all are!" said Popsi. "There are such a lot of white bunchy flowers; look at this one on a stiff stalk—it's not elder, but it's like it!"

"I think it's more like guelder rose," said Topsy, stopping to examine it.

"No, you are both wrong!" said a voice, and quite close to them, in a tangle of traveller's joy, was their good fairy Summer.

"Men call that the wayfaring tree," she said. "Here is the guelder; you may always know it by the outer ring of bigger flowers."

"Oh, Summer darling, there you are!" cried Popsi. "Now you can tell us everything! Here's another bush with bunches of white flowers——"

"Why, you know that, don't you?" said Summer. "Look at the undersides of the leaves—see how light they are! That is the whitebeam; you will see the whole tree flash like silver when the wind blows up the leaves!"

"And here's another," said Topsy; "white clusters of flowers again, but red stems."

"It is the dogwood that has those dark red stems, and in the autumn the leaves are very red, too."

"I think I like the guelder best of all," said Popsi. "But why does she arrange her flowers like that?"

"I will tell you a story about the guelder," said Summer. "Each cluster is one big family, but once upon a time they were a family that did not agree very well; some of them just wanted to dress up in pretty white frocks and shine in the sun and do no work, while the others thought only of work and became quite careless about their clothes.

"At first neither of them got on at all. The showy flowers grew up without any hearts, and lost all power to make berries, and for all their beauty they just dropped off and died. But the workaday flowers fared little better, for though they had big hearts and all the organs for making seeds, yet because they made such

Photo: A. Harold Bastin.

The Guelder Rose may always be known by its outer ring of "show" blooms. Only the inner ones are able to produce seed.

Photos: J. Step, F.L.S.

The Whitebeam and the Wayfaring Tree both grow on chalky soil. The latter has stiff stems and rough leaves, while the Whitebeam's leaves are smooth and white underneath.

a poor show the bees and butterflies passed them by and brought no pollen to fertilize them.

"And so at last they agreed to work together. The big, lazy flowers with their smart white dresses ranged themselves all round their prim little short-skirted sisters, and made such a lovely shining circle that from all around came bees and butterflies, thinking they saw one great lovely flower-head. Then when they looked close they found in the centre the plain little sisters with honey to give in exchange for the pollen they needed to set their seed. So in autumn berries were made, and both flowers lived and died knowing that each had done her part for the good of the whole."

"Oh, thank you!" said Popsi. "I do wonder which flower I should be if I were a guelder!"

"I'd rather have a heart and make berries that would live," said Topsy, "than only have fine petals that drop off and die!"

"But what would be the good if the bees never found you to bring you pollen for your berries?"

"Luckily," said Summer, "little girls can usually do both! So don't forget when you grow up, that to be useful without being beautiful is just as bad as to be beautiful without being useful—you must be both, then you will get on all right! And now there is Boodles calling to you—listen!"

"Are you never, never, never coming?" called Boodles from the top of the quarry.

"Oh, thank you ever so much!" said Popsi again. "We must hurry or Boodles will be seeing the sea before we do! But we won't forget about it"; and away they went, carrying with them sprigs of the different flowers to look at when they sat down to tea at the top.

Photo: E. Step, F.L.S.

The Dogwood is another bush with white cluster-flowers that grows on the chalk.

BY THE SUMMER SEA.

From a Painting by Arthur J. Black, R.O.I

The Common Grey Partridge is a close brooder, and finds splendid cover among the tangled undergrowth.

WILD LIFE ON A YORKSHIRE MOOR

By BENJAMIN HANLEY

With photographs by the Author

SCATTERED throughout our land are districts which might in all truth be termed strongholds of wild life, but it is usually found that in such places the birds reign supreme. Happily the greater number of such storehouses of Nature are known only to a few, for were the exact situation announced to all and sundry the life of peaceful security which the wild creatures now enjoy would be no more. Such a stronghold I have in mind as I write, but beyond stating that it lies in the county of broad acres it shall be nameless.

Situated in a very flat district, it might appear to the casual observer to have no natural charm, yet, although devoid even of the slightest suspicion of rising ground, it possesses a beauty that is fascinating in the extreme. I have spent a portion of my holiday there for more successive years than I care to remember, and its interest never palls.

Here and there amid the countless acres of heather and gorse are great clumps of dark Scots pine, relieved by the graceful presence of the silver birch and waving larch. On one side are large sheets of water, while scattered over the area are oak, spruce, alder, horse-chestnut, white-beam, poplar, mountain ash, hawthorn or alder-buckthorn.

A day spent here is of interest at any season, but the palm must be given to early summer, which displays vast treasures in bird life, and even in its expanse of a

thousand acres there is a wide diversity of species.

On certain of the ponds a colony of black-headed gulls nest, creating a clamour if one draws near their nesting site that is not easily forgotten. Some of the bolder birds will even swoop to within a few inches of one's head, in such threatening fashion that, although one knows quite well the bird will not strike, it is difficult to restrain the impulse to duck the head. Though they nest usually in the reeds and sedges out in the pools, yet I have often found odd nests amongst the dead grass or the heather some few feet from the water, and once I discovered one built in the middle of a narrow footbridge between two pools used in winter-time by sportsmen.

The ponds occupied by the gulls are mostly neglected by other waterfowl, which prefer to nest more in solitude, yet sometimes a wild duck's clutch of eggs may be found quite near the nests of the more noisy gulls. Indeed, on two separate occasions I discovered the nest of a water-rail in the reeds fringing one of the ponds where the gulls' nests were most thickly distributed. I have always looked upon this as somewhat strange, because the water-rail is a very shy bird; it is noted for its skulking habits, and has thereby earned the reputation for being more uncommon than really is the case. Its numbers are, I believe, considerably increased by autumn migrants, but it is frequently an unobserved permanent dweller.

In reedy places where the Coot builds it is rare to find small birds nesting; this bird is inclined to be pugnacious and does not easily tolerate intruders.

In other reedy pools, where silence reigns almost unbroken save for the rustling of the dried reed-stems, the coot holds sway. Here again it is rare to find smaller birds nesting near by, for the coot is inclined to be pugnacious and does not easily tolerate intruders. However, at times a dabchick or little grebe will venture to bring up a family in the same neighbourhood. Strange to say, although the conditions seem eminently suitable, the great crested grebe is not found here, and recently

In rare cases when the Pheasant is monogamous the cock bird will also take his turn upon the nest.

Among other game birds that nest upon the moor, we find the Woodcock, coloured and patterned as to be almost indistinguishable among the grass stems and leaves.

a series of interesting experiments were carried out with the intention of introducing this bird to the neighbourhood. A pair of coots were selected as foster parents and a clutch of great crested grebe's eggs introduced gradually into the coot's nest, the legitimate eggs being abstracted at the same time. The substitution apparently was not detected by the coot, who, after laying her full complement of eggs, undertook the incubating process unaware of is questionable if it would stay beyond the autumn migration. In any case, however, such experiments are of vast interest.

The widgeon abounds here during the winter months, and occasional rare specimens with variation in plumage have been seen. Three or four years ago a cream-coloured bird remained throughout the winter, despite various attempts to secure it for the taxidermist's art. Two seasons ago a pair of widgeon remained to nest on

The Wood-pigeon is interesting by reason of its prolonged nesting season. Young birds may be found from March right through the year to November.

the interest she was arousing. In due time nearly all the eggs hatched, but for some unknown cause none of the young grebes lived long after leaving the nest. Whether the foster parents killed them or whether the food was unsuitable I cannot say, but I think the latter is the more likely explanation.

A second experiment of like nature met with no better result, but personally I am of opinion that if the eggs had been introduced into the nest of a little grebe the chances of success would have been greater. The great crested grebe is such a fine-looking bird that it is really worth some trouble to get it introduced to this bird-favoured district, but even if reared it the moor, a most unusual happening, and I believe I am correct in saying it was one of the few occasions the nest has been recorded in the county. Pochard are also commonly found in winter, and one or two pairs stay to nest, but they are not numerous anywhere during the breeding season, for like most of our native ducks they are vastly augmented by autumn immigrants.

Mention of the experiment with the great crested grebe calls to mind a similar one in connexion with red grouse. Here again the eggs were obtained but hatched under a domestic fowl in the same way as those of a pheasant might be, and the resulting chicks were for some weeks hand reared before being finally turned down

YOUNG TAWNY OWL.

The moor and district is rich in Owls—those useful birds against which anyone should be ashamed to lift his gun.

YOUNG LONG-EARED OWLS.

Long-eared Owls nest among the pine trees. Often they will utter a mewing cry, as if some stray feline were lost in the woods.

amongst the heather in the dryer portions of the moor. Unfortunately, however, this experiment met with no greater degree of success, and I believe only one bird survived the first winter, some being killed by the damp and unsuitable nature of the moor and the remainder falling victims to foxes.

The pheasant lives here in a purely wild state, and the birds appear far more stately and majestic than those brought up by hand and turned out after being partially domesticated. There has been an almost universally accepted theory that the cock pheasant does not take any share in nesting duties, but this was disproved a few years ago by a photograph secured near here which showed the cock bird on the nest, and I have observed the same thing on one or two occasions. This, I am inclined to think, is only done when the bird is monogamous, which is the exception with the pheasant.

The tangled undergrowth provides splendid cover for nesting partridges, both the common grey and the French or red-legged kind. The latter was imported into this part some thirty years ago and is now quite common. The extent to which this bird can run is not always appreciated, but given an inch or so of snow the bird's running powers are more properly observable. So far as the sitting partridges are concerned I have found the grey species is a much closer brooder, whereas the other birds frequently leave their nest on the slightest alarm, and thus are far more difficult to photograph.

The clumps of firs are the favourite nesting places of the wood-pigeon, which here occurs in large numbers. Even during the nesting season scores of nests may be found in very little time, whilst in the winter vast hordes of the birds resort to the pine woods nightly. They are such a pest to the agriculturist by devouring young clover, etc., that during the months of February and March organized raids are made weekly on a fixed day throughout the district. Despite this heavy toll one sees but little appreciable difference in their numbers. The bird is interesting to the nature lover by reason of its prolonged nesting season. It is no uncommon thing to find young birds in March and right through the summer and autumn until November, several broods being brought off by each pair of birds.

The Water-rail is such a shy bird that it has earned a reputation for being more uncommon than it really is.

The wood-pigeon's lesser relative, the turtle-dove, a summer migrant only, is also found in yearly increasing numbers. Though it was rarely seen a few years back, it is now quite common, and last season I found no fewer than seven nests in the course of one short ramble. The green woodpecker also flourishes, and although one may not view its eggs *in situ* the nesting hole is not difficult to discover, and when the young are about to venture abroad it is not without interest. The nightjar is a common visitor, and its curiously scribbled and blotched eggs laid under some whin-bush or in the birch wood may be happened on, but wherever they are placed a novice might well be pardoned for passing them as stray pebbles without a second glance.

The moor and district is rich in owls

The Latticed Heath Moth is a very common sight amongst the heather.

—those useful birds against which anyone should be ashamed to lift his gun. The tawny and long-eared species are found in the woods, and the latter will often utter a mewing cry much as if some stray feline were lost in the wood, whilst amongst the open stretches of heather the daylight hunting, short-eared species may be seen, and, of course, about the old farmsteads on the outskirts of the moor the barn owl is quite common.

Birds such as the hedge sparrow, whitethroat, song-thrush and blackbird are found nesting in close companionship with the bullfinch, lesser redpole or linnet; and, in addition, we find the woodcock, snipe, lapwing, landrail, carrion crow, curlew, sparrow-hawk, kestrel and a host of smaller birds.

Catering not only for the ornithologist, the district offers rich material in other directions, for amongst the heather the viviparous lizard holds its own. On warm sunny days this little reptile is particularly active, and will often astonish the man who handles it unwarily, by the readiness with which it parts with the extreme end of its tail. To some degree it is able to replace the lost portion, for I have come across specimens in which the growing process had already commenced. Here also the viper may be noticed enjoying his noonday siesta, and he makes his living easily in this retreat, by reason of the frogs which abound in the moist places, but he is not above taking eggs or young birds when these are available, and sometimes will even tackle a full-grown water-vole. A few seasons ago I noticed a viper freshly killed with the body greatly distended, and on investigation I found it had swallowed a half-grown rat. Contrary to what one might expect, the grass snake is not found in this locality, although the conditions seem suitable in every way.

The entomologist also will find countless treasures, for butterflies and moths abound. The small heath butterfly, the small copper, the orange tip, some of the blues and skippers, as well as the more common whites, are abundant; and of moths, the glorious day-flying emperor is probably the most noticeable amongst the heather, while the latticed heath is also plentiful. So, too, is the buff-tip, in the vicinity of the birch trees, provided one has eyes keen enough to detect it as it sits at rest looking like nothing so much as a bit of broken twig.

The Green-veined Butterfly and other Whites are abundant all over the moor.

Dragon flies of many species abound, and there is no lack of beetles, the bright sun-loving tigers being more particularly noticeable.

Of the floral treasures to be found in this delightful spot much might be written. One could go into enthusiastic descriptions of the acres of purple heather during August and September; in certain parts of the moor the foxglove rears its stately head as though scorning its more lowly neighbours, whilst the honeysuckle trails its wreaths about the bramble bushes. But more interesting are some of the plants which are not generally found in other districts, and the cotton sedge in full flower presents a spectacle not easily forgotten. To see perhaps a couple of acres of this plant waving its silky tassels makes one wonder if some practical use could not be made of the cottony silk available in such large quantities. Then, too, not far away, one will happen upon that interesting carnivorous plant the sundew, and a little time can well be spent examining it minutely. Other interesting marsh-loving plants are the marsh thistle, the bog-bean, water violet and water crowfoot. On the dryer ground gorse bushes flourish, and some blooms can be found at any season, whilst among ferns the common bracken, the male fern, the delicate polypody and lady ferns abound on all sides. Some of our rarer wild orchids, too, may be seen if one knows exactly where to look for them.

The delicate Lady Fern holds its own amongst the brambles that run everywhere through the luxuriant vegetation.

Fungi are plentiful, and one of the most common is the summer boletus, but more noticeable is the dryad's saddle-flap, which may be found on many a decaying birch trunk. The variegated boletus, the vegetable beefsteak colonies and some of the russules are quickly seen, but the autumn season is, of course, the better time for a fungus foray.

I have made little mention of the mammalian life of this Yorkshire moor, but it is abundant. Foxes are numerous, but, as

might be expected, the rabbits hold the record for numbers. They are present in hundreds, and I have noticed their fondness for nibbling at the young shoots of the gorse until in some cases the shrubs are quite dwarfed and stunted and often have a flat table-like upper surface, on which one may see the rodents sitting. Apart from the foxes the rabbits' natural enemies here are not much in evidence, which explains why they are so numerous. Hares are often seen, but usually they prefer the more open parts, where they are less likely to be surprised. Water-voles, brown rats and field-mice abound, and a few years ago I saw a fine black variety of the first-named animal, a variation not often met with, since albinoism is more common than melanism.

The Buff-tip Moth at rest looks like nothing so much as a bit of broken twig.

That wonderful miner the mole is there, of course, and sometimes golden variations are seen. Squirrels were formerly quite plentiful, but now I am sorry to say they are exceedingly rare, and I am afraid some of the neighbouring keepers could throw a little light on their disappearance. On the other hand, the otter, which formerly was quite infrequent, is now plentiful in and about the river which runs not a great way from the moor, and I had the pleasure of watching a family of six disporting themselves in the water from a hidden vantage point some little time back.

Here the river winds about a good deal, and in winter after a fall of snow I have frequently seen the otter's tracks leading from one bend across country to another, even when they were quite a distance apart, proving the animal is by no means loth to take a short cut overland rather than follow the meandering course of the stream.

The hedgehog is plentiful despite the fact that most gamekeepers look upon him with no friendly eye, and seem bent on his extermination. To many people who are only acquainted with the animal as a rolled-up ball of spines and look upon it as a very unwieldy creature, the speed with which it can get over the ground in its native haunts will come as a revelation. An interesting incident to watch for, too, is its visit to the waterside at the close of a hot summer day.

The stoat is not numerous on the moor itself, but on the outskirts it may be found together with its lesser relative the weasel; the latter, in my opinion, is by far the more bloodthirsty of the two. They are both very inquisitive creatures, and whilst they quickly dart for the nearest thicket on the approach of human footsteps, yet if one pauses for a moment or two and makes no sound it will not be very long before a sharp little head may be noticed peeping out to see what is going on.

One might go on indefinitely describing the inhabitants of this district, which is a never-failing happy hunting-ground for me and my camera, but sufficient has been said to show that even in a flat and seemingly uninteresting district there may be riches in profusion for those who seek them with patience, a little knowledge, and much love for the wild things as one finds them in their own domain.

The Variegated Boletus is one of the fungi most easily found in summer, though autumn is a better time for a fungus foray.

As might be expected, the Rabbits hold the record for numbers among the animals of the moor; they are present in hundreds.

18.—SAW-FLY MARVELS: THE PALISADE BUILDER AND THE SYCAMORE JUMPER

By JOHN J. WARD, F.E.S.

With photographs by the Author

SAW-FLIES are some of the most remarkable insects known to entomological science. There are some hundreds of species, but the greater number are small and inconspicuous—merely tiny flies. They belong to the *Hymenoptera* (*i.e.* the order comprising bees, wasps, ants, ichneumon-flies, etc.), and are characterized by four membranous wings, the absence of a narrow waist, as in ichneumon-flies, the ovipositor of the female consisting of a pair of toothed blades, or saws, with covering sheaths, and forelegs in both sexes bearing two spurs.

The larvæ are very similar to the caterpillars of butterflies and moths, but may be distinguished from them by the rounded instead of flattened head, and by being possessed of from one to three additional pairs of claspers, or "false feet." An ordinary caterpillar never has more than sixteen legs, including its first three pairs of legs proper; but the "false" caterpillar of the saw-fly may have from eighteen to twenty-two—allowing for a few exceptions which have only the first three thoracic pairs. A caterpillar found resting with its tail curled or well elevated, and with more than eight pairs of legs, may be recognized as a saw-fly larva, for the curling of the tail is a very characteristic feature.

The saws of the ovipositor (see photographs on pp. 733 and 734) are most complex organs, used for cutting a slit in vegetable tissues in which the egg is placed. The blades work alternately with a sawing motion, and the egg is passed down between them into the incision.

The Palisade Saw-fly on the edge of a black poplar leaf. (*Magnified two diameters.*)

After placing the egg *in situ*, the mother-insect's interest in her offspring immediately ceases, so far as British species are concerned. Nevertheless, the little larva which emerges alone into the world has to undergo some astonishing experiences before it can become a winged fly, like its parent.

In proof of this statement, let us consider a few details in the lives of two species which have no common names, one of which I will call the palisade saw-fly (*Lygæonematus compressicornis*)

and the other the sycamore jumper (*Phyllotoma aceris*). In the first photograph the former insect is shown at about double its natural size on the edge of a black poplar leaf. The extraordinary life story of this insect was unknown until investigated by the writer in the year 1920. The photograph here shown was then secured, the first to be taken; it possesses, therefore, both historical and scientific interest.

When the fly had been identified, the next business was to discover where its eggs were placed. Eventually I was fortunate in observing a fly spending a considerable amount of time in investigating the central vein on the underside of a black poplar leaf, its feelers being continually used in that occupation. Having satisfied itself that all was in order, it set to work and applied to the vein the pair of saws at its tail-end. Nearly three minutes later, it moved down the vein about one-quarter of an inch, and there proceeded to saw another slit; one other followed about the same distance lower down before it made its way to another leaf to deposit still other eggs.

In each slit, neatly and skilfully cut in the form of a little pocket, before the blades were withdrawn, was placed an egg. In the photograph on page 735, one of these incisions, with its egg enclosed, is shown magnified some ten diameters. It should be noticed that it is bulging open, and that the egg is astonishingly large, considering the small size of the insect which deposited it. In fact, however, the egg *grows* after it is placed in the vein; possibly owing to some substance being left with it, or it may be in the egg itself, which acts upon the leaf tissues—as in the case of gall excrescences.

These eggs I found to be fertile in the entire absence of the male insect. This phenomenon of the parthenogenetic development of the eggs of insects I have referred to in a previous article on "The Wonderland of the Earwig"; but although the second and third batches of the earwig's egg proved fertile, I had no evidence to show that it had not been fertilized for its first batch—which might have influenced those which came later. In the case of the palisade saw-fly I am able to affirm that the eggs of the newly-emerged virgin female produce offspring.

Seven days after the egg is placed in the vein the little larva appears and commences its twelve to fourteen days of wonderful life in that form. It is just visible to the eye when it crawls from the vein, leaving behind in the incision its empty egg-shell, and its

Tail-end of a Saw-fly showing the pair of saws and their covering sheaths.
(*Magnified 25 diameters.*)

first action is to bore a tiny hole in the leaf large enough for it to get inside and rest horizontally on the cut edge. Then, a little distance outside the hole, on the underside of the leaf, it builds its first series of palisades. Having done that, it then passes through the hole to the upper side of the leaf, and there constructs a further set of palisades around the hole on that side. When finished, the hole and palisaded area is barely one-quarter of an inch across. Nevertheless, inside that hole, standing on the edge, with its tail curled and raised, the larva eats its way round and round until it reaches the palisades, which may take it twelve hours or more, so tiny is the larva.

Having reached the palisades, it bites them off, leaving only their stumps, and immediately constructs a larger series outside them; and once more proceeds to

One of the tiny saws with which the Saw-fly cuts the leaf before depositing her egg.
(*Magnified* 125 *diameters.*)

feed, enlarging the hole all the time. When about ten days old it is still feeding on the same leaf, and it is then that its work becomes apparent. In the photograph on page 737 the damage inflicted on the leaf is shown with the larva in its newly-palisaded area. During its feeding period the larva moults its skin three times, and after each moult its first meal is its cast skin.

After feeding for about twelve days on the same leaf, it then prefers a final meal on a fresh one. Leaving its old feeding-ground, it quickly travels along the stem until it reaches the stalk of a new leaf. There its first action is to barricade the stalk, after which it proceeds to build further palisades around its selected area in the ordinary way.

Since the tiny larva comes into the world a born engineer with all the instinctive knowledge of how to build and extend its defensive outworks, it is interesting to discover the kind of enemy against which these palisades are erected. No evidence being available on this point, I had to make experiments; eventually, the barricading of the leaf-stalk led me to suspect crawling rather than flying enemies. My experiments confirmed my suspicion, and, at last, I was able to show that the enemies were—ants.

There is ample space for an ant to pass

between the pillars of the palisade when the larva is a few days old, but it dare not make that passage. Apparently it can *feel* the palisade when it approaches. The columns themselves are simply composed of frothy saliva secreted from the mouth of the larva, which raises its head, draws them into pillar-like form, and then snaps them off. They are flexible and viscid, remaining standing on the leaf for fourteen days or more, if untouched. I am inclined to think that they are extremely pungent to the senses of the ant, and affect it as much as a whiff of strong ammonia does us.

In the case of an ant which accidentally came in contact with a palisade the pillar broke away at its base and struck to the ant's head and body. It had a most difficult task to extricate itself from it, and afterwards appeared to be completely "gassed," undergoing all sorts of extraordinary contortions, as if in the greatest pain. Eventually, it stiffened its legs and reached beneath them so as to get its tail-end in its mouth parts. There it stood rigid, like a ball resting on a double tripod, for over three minutes; and, apparently, it secreted something (probably formic acid) which neutralized the effects of the poison; for, afterwards, it slowly regained its steadiness. Later on, it seemed completely to revive; but it had learned its lesson, for whenever it found itself approaching a palisade, it at once commenced backing, and would immediately select another path.

There are usually three or four eggs placed on one poplar leaf, and the larvæ are generally nearly full-fed before they leave their first leaf.

While the palisades proved an effectual defence against ants, they obviously did not protect their owner from its winged enemies. Some pupæ which I had produced ichneumon-flies instead of saw-flies; one of these is shown at about three times its natural size in the photograph on page 736. The thread-like waist readily distinguishes the parasite from the saw-fly proper.

At the end of thirteen or fourteen days the larva leaves the tree and descends to the ground, where it forms a little brown silken cocoon, either on the surface of the soil, or attached to fallen leaves. In the ordinary way it lies by until the following spring; but, occasionally, a late summer brood appears about the end of August, the offspring of which then pupate for the winter.

To show how marvellously different are the life stories of these curious insects, let us now consider some details in the economy of the sycamore jumper saw-fly.

This species, like the former, is only about two-thirds the size of the common

Portion of the leaf-vein where the egg of the Palisade Saw-fly has been deposited showing the "pocket" cut by the fly's tiny saws, with the egg inside. (*Magnified* 10 *diameters.*)

house-fly, and the protective devices of the larva go one better even than that of the palisade saw-fly. The mother insect selects the sycamore leaf for the application of her pair of saws. Alighting on the leaf, she makes her way to the tip of one of its five lobes and there cuts a small incision between the upper and lower surface skins of the leaf. She may deposit two, or sometimes three, eggs on one leaf—each at the tip of a lobe.

A few days later, the egg hatches; and Nature's instinctive warning to the tiny larva is on *no account ever to expose itself to the open air*. There, all sorts of dangers await it; ants, lady-bird beetle larvæ, hover-fly grubs, ichneumon-flies, spiders, and

many other foes, are always ready to attack it. Consequently, it becomes a leaf-miner, burrowing between the surface skins and

The Ichneumon-fly—the enemy that ignores the palisades of the Saw-fly larva. (× 3 di.)

feeding only on the soft green internal tissues. While there it is comparatively safe, although I know at least one species of ichneumon-fly which will pierce its leaf-skin defence.

After feeding for ten or twelve days, its feeding-ground presents a bleached area where the green part of the leaf has been removed; and about that time the larva has consumed all the food that it needs. The next stage of its development is on the ground; as its instinctive warning was never to expose itself to the open air, this journey earthwards seems an impossible proposition.

Never heeding, the full-fed larva prepares to make that journey. At the end of its feeding-ground it applies its mandibles to the upper surface skin of the leaf and cuts a minute slit; then, missing a portion of about the same size, bites again. In this manner it perforates an almost perfect circle. The circle is about the diameter of the larva's length, but since it is turning round its body the whole of the time it is cutting, it is somewhat astonishing how it retains its centre. However, it completes the work with the skill of an expert geometrician—as shown in the upper photograph on page 738.

Then for several hours the larva is occupied with internal arrangements. Beneath the perforated disk it constructs a new floor. This floor is a marvellous piece of work, being accurately built to size, neatly joined at its edges to the ragged perforations, and firmly attached around the whole edge of the disk. It is semi-transparent, very elastic, and of a gelatine-like substance—a kind of liquid gum, spread in a sheet, and secreted from special glands of the larva. In this extraordinary manner the larva prepares a "Pullman Car" of its own design, weather-proof and comfortable, for travelling in.

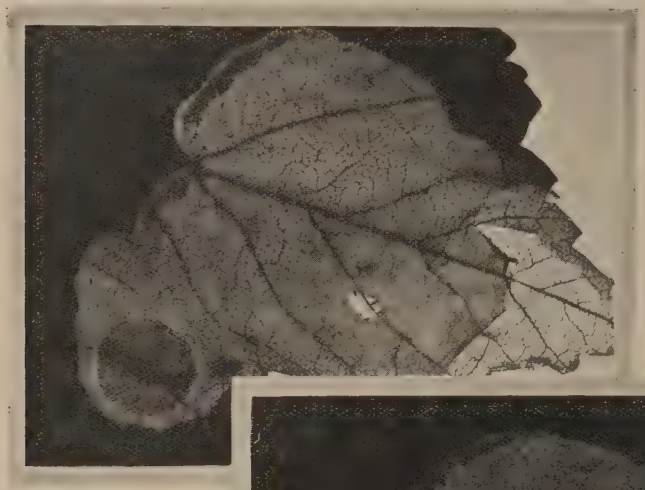
A Sycamore leaf showing in the left top-corner the Jumper grub feeding, and in the right lower corner the work of one that has left the leaf.

The larva of the Palisade Saw-fly first makes a circular palisade of some apparently poisonous secretion, and then, secure from all but flying enemies, eats away the black poplar leaf inside. (× 2 di.)

As the upper skin of the disk is now completely separated from the leaf, it shrinks slightly as it dries (see page 738), causing it to curl up around its edges. The air then gets under the disk, until it is held only by the centre of the elastic lower floor. To remove it from the leaf some amount of force is required ; and the stimulus for this effort is provided by the warm days of the sun —against which the larva has a considerable antipathy.

So soon as the sunlight reaches the leaf

and the larva feels its warmth, holding to the inside edge of the disk with its mandibles, it strikes out forcibly with its tail-end, giving a series of sharp kicks, which are quite audible, each one making a distinct click in the hollow disk. The more the sun shines upon it, the greater becomes its efforts to escape, until, at last, the vibrating disk is suddenly jerked from its hold (p. 739). It may at once fall to the ground, or on to the surface of the same or another leaf, but if the sun still shines upon it the larva kicks out again until it falls to the soil.



The eaten portion of the leaf photographed against the light showing the grub of the Sycamore Jumper within perforating a circle of the upper skin in readiness to leave the leaf. (*Magnified 2 diameters.*)

When the lower floor is added to the disk it dries and shrinks until at last the grub can jerk it free. (*Magnified 2 diameters.*)

Even on the ground, if the bright sunlight still reaches it, the disk jerks about in the most astonishing manner. At last it reaches a shady and cool spot, and there it comes to rest. If, later on, the sun works round to that spot, it once again commences to travel until it finds a suitable, shaded area amongst fallen leaves or in some similar cool and moist place. That, indeed, is the object of its jumping, for otherwise the larva would soon be scorched up in the rays of the sun. In that disk it has to lie by, without again feeding, from early July throughout the remainder of the summer, autumn and winter, until June of the next year. Even in May it is still able to jerk its disk about; but about that time it changes to the pupa state, still inside its disk; and a week or ten days later the tiny saw-fly has matured, and bites its way out in readiness for aerial life.

How very different are the methods adopted by the two species of larvæ here described, yet these two insects' life stories are almost identical in all essentials—the egg on the leaf, twelve to fourteen days' feeding, and nine or ten months' resting period covering the winter. In each case there is that marvellous complexity of details—cunning problems overcome by ingenious tactics; deep-laid schemes of

which the grubs themselves know nothing, yet which their blind instinct guides them to fulfil step by step from the moment of their birth, the enemy ever watching to circumvent their movements, and so always keeping them up to standard. And for

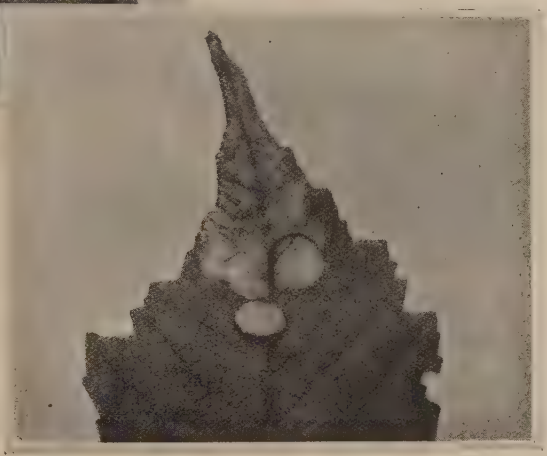
With a series of jerks the Sycamore Jumper grub detaches the disk from the leaf.

what and why are all these things?—to produce two tiny flies whose sole mission in life is to do some infinitesimal damage to a few sycamore and black poplar leaves. One has to pause to wonder if Nature is most a consummate artist or an intricate joker.

Even the little disk with its enclosed larva is much more complex than at first it appears to be, for its movements are, apparently, defying the laws of mechanics. Put a boy in a closed box, and ask him to jump about; surely he would be up against a difficult problem, for, standing on the bottom of the box, how could he spring it up from the ground, or turn a complete somersault with it?—as the sycamore jumper larva often does. That needed explanation. I therefore applied the microscope to that second floor of the disk, and I found that its inner surface was spread with an irregular network of silken threads. So the larva's secret was revealed—its method of locomotion was a *catapult action.*

Holding to the edge of the disk with its strong mandibles, the moment it feels too warm it swings the end of its body to one side, and there, by means of a clasper-like organ at its tail-end, takes hold of some of the network on the flexible floor. Pausing for an instant, it then forcibly swings its tail-end to the opposite side, and lets go the threads. The elastic floor then acts like a spring board, and, with a click, jerks the disk along. That is why the larva provides this specialized floor instead of using the lower skin of the leaf which would not have sufficient propulsive power.

While holding in one position,



A moment later the disk is free and jumps off the leaf to the ground.

it pursues a fairly definite path; but should it desire to alter its course, its "rudder" is changed—by moving its mandibles to another part of the disk's edge—and it again kicks out.

Wonderful as these details are, they are not more so than the saliva palisades which remain viscid and flexible for a fortnight without drying up. What is their secret? It is a chemical problem of which the larva alone possesses the solution.

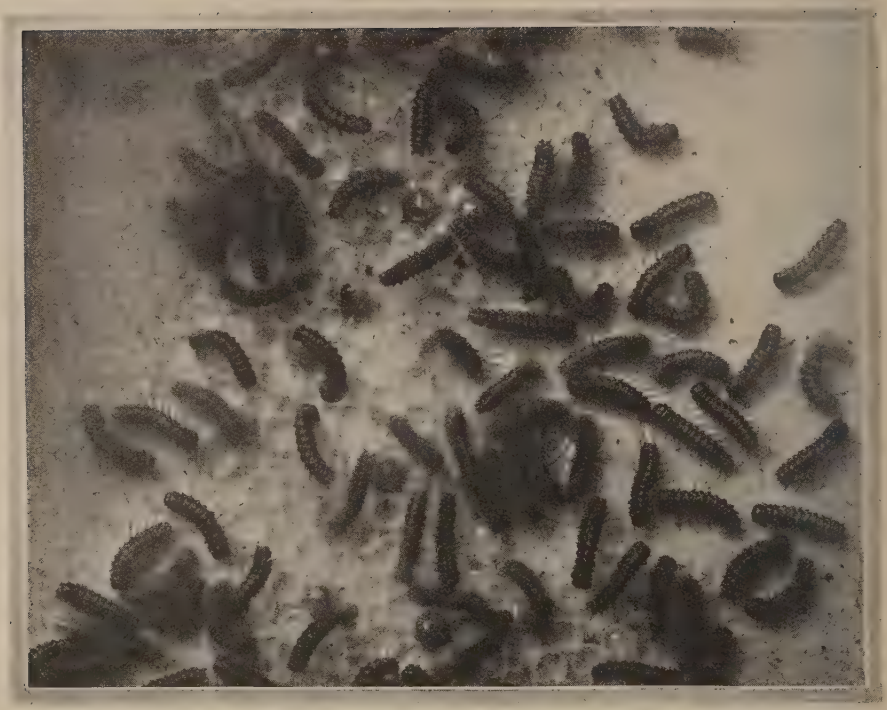


Photo: M. H. Crawford.

The eggs of the common Tiger Moth are laid in vast quantities The larvæ eat off the upper half of the egg before extricating themselves.

19.—THE EGGS OF SOME OF OUR MOTHS AND BUTTERFLIES

By M. H. CRAWFORD

THESE eggs are among the smaller objects in nature, beautifully formed, beautifully coloured, incredibly plentiful. But, in spite of their beauty and their countless numbers, they come and go almost unnoticed. They abound in every field, every orchard, every garden, every cabbage patch, but few people look closely enough to discover specks that can be measured somewhere between the sixtieth and the tenth part of an inch.

Another obstacle to their discovery is the fact that the insects usually deposit them on the underside of the leaf. Still, the difficulty is not insuperable, and if, for instance, search were made in a gooseberry bush for magpie moth's eggs there would be but little difficulty in finding some; they are as easily seen as the leaf-ribs. They are of a creamy-yellow colour and rather flat, and, especially when first laid, present a strong contrast to the dark green

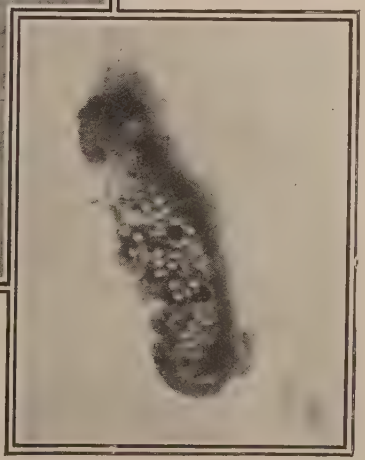
A Leopard Moth in the act of depositing its orange-coloured eggs. Though nearly at the end of her life, she laid about 100 eggs. (× 2.)

of the leaf. When the eggs can be so easily seen and therefore so easily destroyed, no grower of bush fruit should have his crops spoilt by magpie moth larvæ.

Still more easily detected are the eggs of the large yellow underwing moth, *Agrotis pronuba*. They are white when newly laid but quickly turn to brownish grey. The moth does not seem at all particular where she lays them. Probably she enjoys life till she is tired of it, and then lays her eggs anywhere and dies. The photograph (p. 742) shows the way they are plastered over the leaves and twigs, in beautiful symmetric fashion. They were found during the summer on a twig of broom, and a magnifying glass showed them to be standing upright, strongly ribbed up to the exquisite network of the micropyle. As the larvæ are very harmful an attempt was made to destroy these eggs with a fine spray from a syringe, but probably it did not do much good. Though the shells of the eggs of the lepidoptera are thick or thin, hard or soft, sometimes semi-transparent, sometimes opaque, they are always difficult to destroy when they are laid in such large quantities, and there must have been many hundreds of the yellow underwing's eggs on the broom bush.

The eggs of the common garden tiger moth are also laid in large quantities, and like the yellow underwing, this moth does not much care where she lays them. This does not seem to matter to the larvæ, however, who, as soon as they are free from the shells, glide away to find food. It will be seen from the photograph (p. 740) that the larvæ eat off the upper half of the egg before extricating themselves.

The Brown-tail Moth with its case of eggs covered with down from its body.



Photos: M. H. Crawford.

The egg case (enlarged), opened to show the eggs.

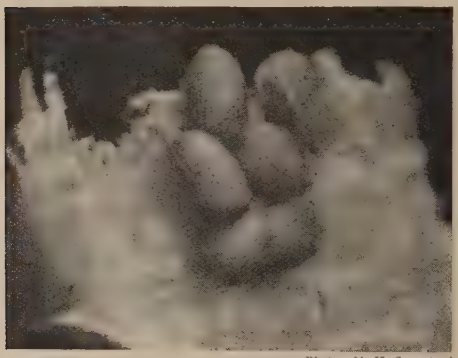


Photo: M. H. Crawford.

The ribs on the eggs of the Dotted Border Moth sometimes catch the light and make the egg appear almost illuminated.

There are two little moths belonging to the *Liparidæ* family, with white wings and big tufts of hair at the end of the abdomen. Their arrangements for egg-laying are peculiar. They wrap up their eggs in a thick case made of the tufts of hair, in order, one must suppose, to protect the eggs from the weather or from birds, who generally detest anything hairy. It would almost appear that the moths had some sort of knowledge or consciousness of this. The brown-tail (*Liparis chrysorrhœa*) is not quite so common as the gold-tail (*L. auriflua*). It was a brown-tail I took one summer day from a fence in the garden where it was resting. I boxed it and hoped it would lay eggs, for I wanted to see the exact process. But unfortunately it chose night for the operation, when my watch was relaxed. However, the bag was there in the morning exactly as shown in the photograph (p. 741). I turned it over carefully and found a very thin layer of hair underneath. When the larvæ hatched out of the tiny eggs they would be easily able to escape without having to push their way through the thickest part of the mass of hairs.

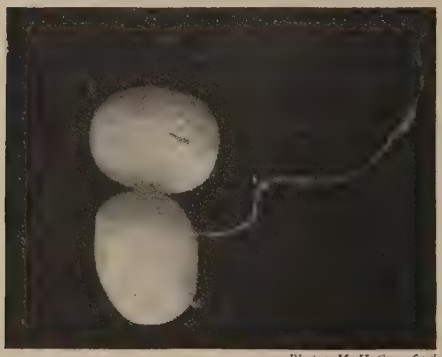


Photo: M. H. Crawford.

The Yellow Horned Moth lays beautiful eggs on birch leaves in early June. (× 20.)

Photo: M. H. Crawford.

The eggs of the Yellow Underwing Moth are laid on twigs and leaves in enormous numbers. These were laid on broom. (*Enlarged.*)

Very unlike the quiet, sleepy little brown-tail was a beautiful leopard moth

Photo: M. H. Crawford.

The eggs of the Emperor Moth are laid on willow or blackthorn, or in the garden on raspberry leaves.
(*Magnified* 20 *diameters.*)

that was once brought to me. Though nearly at the end of her life, there was still an appearance of fierceness in her white and black wings, her white, black-spotted thorax, and in the resolute grip she took of the board on which she was carried. She had flown till she could fly no farther, but she could still grip. In the photograph (page 741) can be seen her powerful forked claws, her remarkably short antennæ, her white head and thorax with the six large blue-black spots, and her white, semi-transparent wings with black markings. It will be noticed, too, that these wings are short and tattered, and do not nearly cover the abdomen, a proof that they were worn out and would no longer bear her. Her twilight flights had been swift enough to save her from bats, always on the look out for the big leopard moths, but her wings had failed her at last, and she had dropped to the grass. No moth, however, unless fatally injured, dies without fulfilling her duty to posterity, and she had still sufficient strength for that duty. She made several efforts to fly, probably to reach the bark of some tree, which was the proper place for her eggs, but her wings were weak and useless, and finally she settled where she was. With her pointed, polished ovipositor she laid about one hundred eggs; they were oval-shaped and orange-coloured. They should have hatched out within a few days, but no

Photo: E. A. Bolling.

There is endless variety in the shape of the eggs of moths and butterflies. This shows some (greatly enlarged) from the Lackey Moth, laid on an apple leaf.

Photo: E. A. Bulling.

The eggs of the Red Underwing Moth are most intricate in structure. The apertures show where the caterpillars emerged.

Photo: M. H. Crawford.

Eggs of the Magpie, or Currant, Moth shown slightly larger than life-size.

caterpillars ever appeared. Probably circumstances were against their maturing; their real home would have been in some deep crevice in the bark of some pear, apple, beech or birch tree.

The other photographs represent eggs that have all been highly magnified, showing to some extent the immense differences that exist as regards size, ornamentation, and shape. Colour differences cannot, of course, be seen, but they are still more wonderful.

The eggs of the emperor moth are laid in the early summer on willow and blackthorn, and in the garden they may be found on raspberry leaves. They are of a brownish-yellow colour, with a dark mark at one end; oval in shape, with large hollows. Though they are so large, their colour protects them, and it is difficult to find them amongst the leaves.

The milky-white eggs of the scarce small skipper butterfly are very tiny but very interesting. The shell is so thin and transparent that for some days before the larvæ emerge these can be distinctly seen slowly and gently squirming round and round; they are black-headed and white-bodied; even the segments on the body can be clearly seen. The surface of the egg is very finely marked, but these markings can only be detected if the egg is magnified at least fifty times. The larvæ feed amongst grasses, and this is where the eggs are laid. Many eggs are obviously squeezed and slightly flattened when laid in stems and grasses, and I think this may be the case sometimes with this particular butterfly's eggs. A slight

SILVER-STUDDED BLUE BUTTERFLY (*LYCÆNA ÆGON*) RESTING ON CROSS-LEAVED HEATH

Photograph by T. M. Blackman

FEMALE EMPEROR MOTH (*SATURNIA CARPINI*) AND THE COCOON FROM WHICH SHE EMERGED

(*Life Size*)

Photograph by T. M. Blackman

BRIMSTONE BUTTERFLY (*GONEPTERYX RHAMNI*)

WHITE ADMIRAL BUTTERFLY
(*LIMENITIS SIBYLLA*)

SILVER-WASHED FRITILLARY BUTTERFLY (*ARGYNNIS PAPHIA*)

In each case the butterfly has just emerged from the chrysalis

Photographs by T. M. Blackman

TIGER MOTHS

The top one is a female just emerged from the chrysalis : the wings are not dry

Photograph by Stanley Crook

Photo: E. A. Bolling.

The delicately formed eggs of the Dot Moth (greatly enlarged).

flattening inside this grass-blade has certainly not injured the larvæ within the egg. The dark mark made by the caterpillar's head can be seen very distinctly when the egg is examined under the microscope.

The eggs of the dotted border moth are about twice as long as broad. They are longitudinally ribbed and have also smaller transverse ribs; these make little projections which catch the light and make the egg appear illuminated. Then there are three clear, distinct colours on each egg, red, green, and yellowish-orange; the colours are always there, though their proportions and positions vary. They are less clear as the egg nears maturity, but until the larva emerges these tiny eggs are amongst the loveliest I have ever seen.

The egg of the chalk hill blue butterfly stands upright, and is pure white, covered with little spikes, or pointed projections, with the micropyle in the centre. The part immediately round the micropyle is not covered with projections, but with a fine network.

No uncoloured photograph can do justice to the beautiful little egg of the early thorn moth. It is bright red, slightly oblong in shape, and has a depression in the middle. It is also very finely pitted all over. The

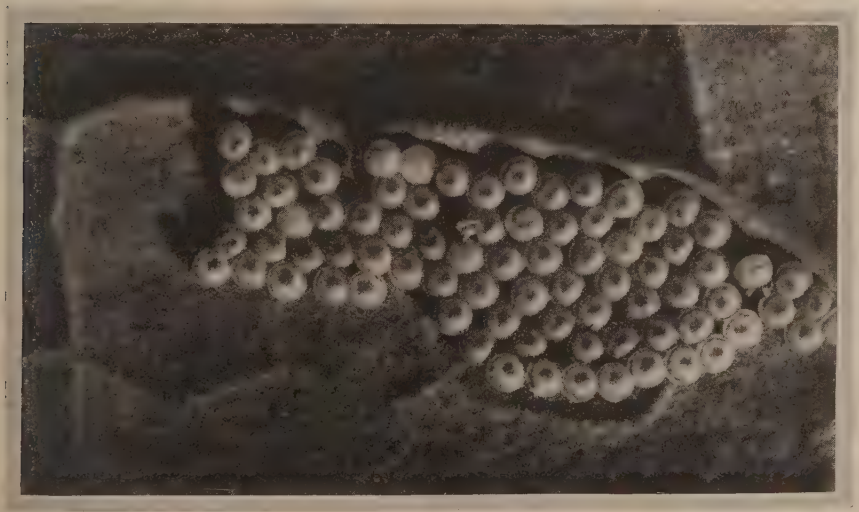


Photo: E. A. Bolling.

Eggs of the Cabbage Moth crowded together on the leaf of a cabbage (greatly enlarged).

eggs are generally found on willow and alder trees, but often on fruit trees also.

The dark brownish-green eggs of the August thorn moth are oblong in shape, and at one end have a pale buff raised ring round the micropyle. They look, on the whole, very much like little tubs.

The yellow horned moth lays beautiful little eggs on birch leaves in early June; they are white tinged with yellow, and the surface is very finely ribbed. The shell is soft and a mere touch is sometimes sufficient to crush it. The photograph on p. 742 gives some suggestion of its fragile beauty.

The tiny white eggs of the high brown fritillary are very much like those of the chalk hill blue butterfly in size and formation; they are rather like minute sea-urchins.

20.—THE ENGLISH CICADA

By C. W. COLTHRUP, Z.P.C.

THE English cicada is one of our rarest and most local insects. It has twice been recorded as being taken in Surrey, but it is in the New Forest that it has been most frequently met with. In this district on June 11th, 1901, I had the good fortune to re-discover one of the breeding haunts of this interesting insect. I was attracted by the continuous "singing" of an insect which was strange to me and, following up the sound, found a cicada sitting on its nymph case, from which it had only recently emerged.

Visiting the spot again in June, 1907, in company with a friend, we only found three empty nymph cases from which the insects had recently emerged. In subsequent years my friend found both nymphs and perfect insects at the same spot, showing that the cicada breeds there regularly, but the date of emergence appears to vary with the weather, as in 1912 he found empty nymph cases on May 19th, and on one or two visits I have since paid to the locality in June I have only been rewarded with empty nymph cases.

The breeding haunt is a grassy bank with a south-westerly aspect that receives a maximum amount of sunshine.

Photo: C. W. Colthrup.

The Cicada, though well known in warmer countries, is one of the most rare of all our English insects.

The "song" is a continuous chirp, more musical than that of the grasshopper, and reminding one of the churr of the nightjar, as it rises and falls in tone, although it is on a very high-pitched note.

The cicadas, of which this is the only British representative, were well known to the Ancients, who kept them in cages, and poets, from Homer onwards, have written in praise of their song.

36.—THE KITTIWAKE AND BLACK-HEADED GULLS

By RICHARD KEARTON, F.Z.S., etc.

Photo: R. Kearton, F.Z.S.

The Kittiwake builds its nest on ledges, sometimes in incredibly small corners of ocean cliffs—

THE kittiwake gull may be classed as the most maritime member of its family. In the winter its home is out on the open sea unless driven ashore by long continued gales of wind, and in the spring it builds its nest on ledges and sometimes in incredibly small corners of ocean cliffs. There is little need to describe the bird in its breeding quarters because it tells the merest tyro its name in the plainest of plain language whenever he or she nears a cliff upon which it is nesting by crying out *Kitti-waake, kitti-waake, kitti-waake.*

The species is gregarious. At some places where the nesting accommodation is limited only a few pairs may be met with, but at others, such as the Noup of Noss in the Shetlands or the Saltee Islands off the Wexford Coast, where conditions are favourable, large colonies breed every year. I have good reason to remember this gull, for a visit to a colony nesting on ledges

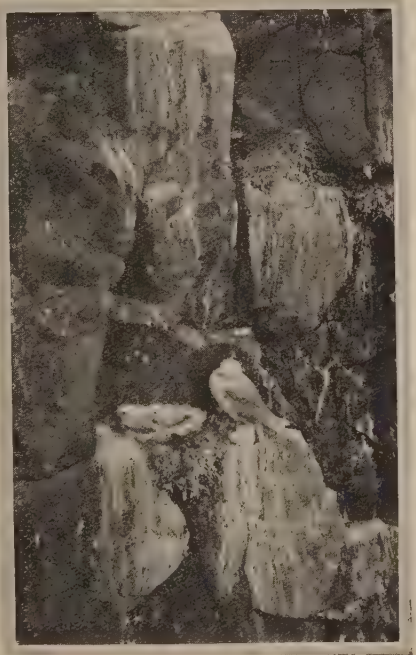


Photo: R. Kearton, F.Z.S.

and spends a good deal of time watching over its young.

forming the rough archway to a cave in St. Kilda very nearly cost me my life. Only once have I come upon members of this species breeding on the face of a little broken cliff where I could climb about amongst the birds unaided by a rope.

The kittiwake is said to be as abundant in the northern parts of the Western

Photo: R. Kearton, F.Z.S.

In winter the Kittiwakes spend their time on the open sea, but in the spring they congregate on perilous cliffs for purposes of nesting and breeding.

hemisphere as in similar latitudes of the Old World, and also that individuals will follow a steamer right across the Atlantic. I cannot vouch for the truth of this latter wonderful aerial performance. My own experience has been that the birds will follow a boat in dwindling numbers to a point two or three hundred miles west of the Irish coast and then disappear altogether until the vessel reaches a point at a corresponding distance from the American shore; precisely the same kind of thing happens on the return journey.

Perhaps the greatest breeding station of this species in the world is the Swartholm promontory not far from the North Cape. The colony has been described by a careful observer in the following astonishing terms: "They hide the sun when they fly, they cover skerries when they sit, they drown the thunder of the surf when they cry, they colour the rocks white where they breed." Another ornithologist, who visited the promontory with a companion, endorses this apparently extravagant description in the following terms: "A shot from my friend's gun thundered against the precipice. As a raging winter storm rushes through the air and breaks up the snow-laden clouds till they fall in flakes, so now it snowed living birds. One saw neither hill nor sky, nothing but an indescribable confusion. A thick cloud darkened the whole horizon, justifying the description 'they hide the sun when they fly.'"

So far as my experience carries me, only

Photo: J. S. Rattar.

KITTIWAKES ON THE NOUP OF NOSS.

Where breeding accommodation is limited only a few pairs of Kittiwakes may be seen, but on such inaccessible places as are shown here they breed each year in vast numbers.

Photos: R. Kearton, F.Z.S.

Solitary pairs of Black-headed Gulls will occasionally breed on the shores of small tarns.

The nest varies considerably in structure; sometimes it is composed only of a few straws or bents.

at one place in the British Isles can a similar sight be witnessed, and puffins instead of kittiwakes are the actors. On the little island of Soa, a satellite of St. Kilda, these birds breed in such vast numbers that when flying over the visitor they literally darken the air.

Although as a rule the kittiwake is a gentle, peaceful creature, bitter quarrels occasionally take place in the early part of the breeding season over the possession of a nesting site or the selection of a mate. At such time I have watched a brace of birds—presumably males—fight a duel to the death.

After they are mated the birds are very lavish in their affections, the male feeding his wife on the nest and taking his share in the work of incubation.

A NEST AMONG THE NETTLES.

Usually the Black headed Gull builds upon the ground, though occasionally nests have been found high up in trees.

Photo: R. Kearton, F.Z.S.

Black-headed Gulls breed inland. Great colonies may be seen in marshy places such as Scoulton in Norfolk, or on the sandhills at Ravenglass in Cumberland.

In former days the kittiwake was considered as good a bird on the table as a partridge, and Pennant tells a story of a gentleman who "in order to whet his appetite before dinner ate six, but did not feel himself a bit more hungry than when he began."

The nest is made of seaweed and dead grass, and the eggs, generally numbering three, are stone colour tinged with olive and spotted with light brown and ash grey.

Naturalists have tried, without success, to alter the name of the black-headed gull to brown-headed, which certainly would be more accurate.

It is often wrongly concluded by the man in the street that this is the common gull, because it happens to be by far the commonest member of the family. The brown head is a sort of wedding-dress ornament, dispensed with in August and re-donned in the early spring.

In the winter, when the two species become considerably intermixed on their feeding grounds, the following hints may help towards correct identification. The head of the common gull is streaked with grey, whereas that of its relative is blotched with brownish grey on the ear coverts.

It is gregarious, great colonies breeding at such marshy places as Scoulton in Norfolk (where it bred in considerable numbers even in Sir Thomas Browne's day) and such dry, sandy stations as Ravenglass in Cumberland, where conditions are as different as they can possibly be. I have, however, on several occasions met with solitary pairs breeding on the shores of small tarns situated high up on the lonely moors of the Pennine Range.

With rooks and starlings the black-headed gull shares the good things turned up by the plough all over the country, and I doubt whether it ever secures much of its food at sea excepting at the mouths of estuaries and tidal rivers. At any rate, I have spent days on end at Ravenglass in the breeding season without ever once

noticing a bird fly out in a seaward direction in search of food for its young or itself.

During the severe winter of 1895 black-headed gulls were driven by hunger into the very heart of London town itself in search of food, and the inhabitants of the metropolis were amazed to see them sitting in hundreds on the gunwales of barges and other kinds of craft, or resting disconsolately upon blocks of ice that floated up or down stream according to the set of the tide. There is probably no man in the world quicker at seizing an opportunity than the average Londoner, and in a few days a grasper of trifles, seeing the birds were hungry and the public interested, went straight off to a fishmonger's shop and invested all his capital in scraps and offal. Spreading his wares on the parapet of the Victoria Embankment, he soon had a crowd of hungry gulls taking advantage, and with almost equal celerity he gathered round him a crowd of interested humans. Then round went his old bowler hat with the irresistible appeal—"Remember the pore starvin' birds, ladies and gentlemen," and bronze rang on bronze right merrily. The man afterwards told me that he was doing very well for the birds and himself too, and his business acumen and humanity richly deserved all the success with which he met.

The gulls have visited London with unbroken regularity since those memorably hard times, and delight errand boys on the bridges spanning the Thames by catching bits of cheese, of which they are very fond, and other edible trifles tossed into the air for their benefit.

The nest is generally built on the ground, although some have been found at a fair height from it. The structure varies very considerably in character according to the industry or opportunities of the builder. I have come across some consisting only of a few straws and others quite elaborate in their building.

The eggs number two to three and vary greatly in size and coloration, but the situation of the nest and the presence of its owner prevent any difficulty in identification.

Photo: R. Kearton, F.Z.S.

The young Black-headed Gull in its first coat of feathers differs widely in appearance from its parents: its plumage is brown and white.

Photo: S. W. Tayler.

When the Partridge nests in banks or hedgerows she is safe from the mowing machines, that make such havoc of nests and eggs in the hayfield.

37.—"THE LITTLE BROWN BIRD"

By FRANK BONNETT

PERDIX CINEREA, the common or grey partridge, is everyone's favourite, and has from time immemorial enjoyed the distinction of being the most popular of British game-birds. It is, of course, because of his capacity for providing sport that he is so highly esteemed by hose who use the gun, but his popularity does not by any means begin and end with shooting. A rather conspicuous bird in autumn and winter, the partridge is familiar enough to those who live in the country, while even the town-dweller, if he keep his eyes open during a journey by road or rail, cannot fail to make the acquaintance of the "little brown bird" at more or less close quarters.

The bird, by the way, takes but little notice of traffic, having learned by experience that danger is rarely to be associated with vehicles of any kind, though be it said that the poacher, taking advantage of this very fact, has sometimes "browned" a covey at easy distance from a cart passing along the highway. As a rule, however, it is quite easy when one is riding, either on horse or cycle, or driving in any wheeled vehicle, to pass within close range of the feeding covey, while partridges take so little notice even of trains that they may frequently be seen on the embankment while an express goes past within a few feet of them. On one occasion the writer saw from the train a covey behave curiously in such circumstances. In this case the birds were to some extent alarmed, but only so far as to make some of them run a few yards up the bank, while the rest took to wing, only to settle on the crown of the clipped quickset hedge at the top of the embankment. There they calmly sat and watched the train go by. French or red-

leg partridges will sometimes settle on a fence or made hedge, but for English birds to do so, as in this instance, is certainly very unusual.

The partridge, without doubt, has adapted himself to the circumstances of civilization better than a good many wild birds, and this is the more surprising seeing that he has to put up with no small share of persecution during the shooting season. But the bird's habits, though still very much what they have always been, have been adapted readily enough to altered conditions, so that instead of retiring to the wilder and uncultivated parts of the country, the bird actually prefers to have its being in the midst of man's activities, whenever he finds he can exploit them to his own advantage. The partridge, in fact, always has a preference for cultivated districts, for there, by the constant turning of the soil, he is enabled to thrive the better. Food of all kinds is more abundant in such places, while the cover provided by cultivated crops is better than that to be found in untilled areas.

Photo: E. W. Tayler.

When startled the young Partridge sinks close to the ground, crouching motionless until it feels it is safe to creep away. Its plumage forms a perfect camouflage.

In the nesting season, so long as it confines itself to the wilder places of bank and hedgerow, the partridge runs but little risk of being interfered with by man's operations; but as it happens, the bird is only too fond of seeking its nest in the meadows laid up for hay. It may be that out in the fields it enjoys a greater sense of security from four-footed vermin, whose habit it is to frequent banks and ditches, and to work the hedgerows pretty thoroughly for plunder. If that be the partridge's idea in making its nest so often among the crops, it is unfortunately the case that in trying to avoid one danger it unwittingly runs into another. For the number of nests "cut out" by the machine in the hayfields each season is considerable, while even the human mower with his scythe does not always see the nest in front of him until too late. Many a clutch of eggs is thus destroyed, while at times even the sitting bird may be killed on her nest.

It is in early seasons, of course—when the bulk of the haycrop is cut before the latter end of June—that the partridge is most likely to meet with disaster in the hayfield, though in any year some nests are destroyed in the harvesting of that favourite mixture of rye grass and clover known to the farmer as "seeds." This particular crop is often cut as early as the end of May, and in the south of England, at any rate, never much later than the middle of June. In any case it is for the partridge a choice of two evils—greater danger at man's hands if it nest in the hayfields; greater risk from four-footed enemies if it keep to the hedgerows. The keeper, at least, can in the latter instance help matters by seeing that the partridge's foes do not become too numerous, or that the nests are protected by some means. If the birds could be induced to nest only in the corn,

they would be safe enough so far as disturbance from mankind is concerned, for by the time the clattering reaper comes along even the latest broods will have learned well enough how to take care of themselves.

Although partridges can be very easily domesticated, and will sometimes, during the close season, display a surprising amount of confidence in man, they are by nature exceedingly wary birds—ever watchful of possible enemies and taking every precaution to protect themselves and their fellows. A single note of alarm uttered by some suspicious bird immediately warns every partridge in the vicinity that danger may be at hand. Thereupon each bird either crouches close to earth so that it becomes practically invisible or, if cover be near at hand, retreats hastily in that direction. When frightened, though not actually compelled to rise—as is the case when man or beast comes suddenly upon them—partridges prefer to skulk away on foot or to make themselves as invisible as possible, and no one without experience can realize how effectively—even on bare ground—a brood of young partridges can conceal themselves. They appear, apparently, to sink into the ground, crouching there perfectly motionless until they feel it is safe to creep away. Meanwhile their parents will either crouch with the brood or scurry into adjacent cover, from which refuge they can watch their brood until the danger passes, or the need arises for taking some other measures for safety.

But the old partridges do not desert their young even by these few yards unless they are assured that this is the safer course. They know that they themselves, being larger and more easily seen than their brood, are better out of sight, and the young ones understand the circumstances perfectly well. But should the danger become more imminent, the old birds immediately show themselves, taking short flights just off the ground or fluttering around with the object of diverting attention from their offspring to themselves. The intruder—human or otherwise—is naturally attracted by the antics of the parent birds, and in the meantime the young ones creep away to safer quarters. Their object accomplished, the parent birds take cover also. In a few moments they will have rejoined their brood, and the enemy, real or supposed, will find it almost impossible to locate them. Occasionally, perhaps, a very quick and

Photo: Kiley Fortune, F.Z.S.

Partridges will eat wireworm and other noxious insects, but they also feed largely on the seeds of weeds, and thus help the farmer more than he knows.

clever fox or cat, stoat or weasel, may be smart enough to capture one or two of the little ones, but this is the exception rather than the rule. The whole thing is so quickly and cleverly arranged that the ruse rarely fails.

The danger to partridges from four-footed enemies is, in any case, far greater before the young are hatched than after they have left the nest. Some prowling creature may surprise the sitting partridge on her nest, or may come upon her just as she is hatching or before she has had time to get away with her little ones. It is a common belief that the sitting game-bird gives off no scent to betray her presence, and that even the keen-nosed fox will pass her by. But, unhappily, this is not always the case, though it is easy enough to believe that a bird sitting tight on her nest carries but little scent compared with one that is on the move. Danger to the sitting partridge, so far as scent is concerned, arises chiefly at the time when she is "sitting light": immediately before or just after hatching; or, again, when she has but just returned to her nest.

For this reason, various methods have been devised to protect her. Sometimes the keeper will surround her with a cage of wire-netting; at another time he will taint the ground round about with some strong-smelling substance in order to drown her natural scent; or he may stretch strands of fine wire round about in the hope that the always suspicious fox will blunder into them should he come nosing round, and fearing a trap, immediately beat a retreat. The partridge seldom resents any of these keepers' devices to ensure her safety, so great is her devotion to her nest and eggs. Perhaps she realizes the good intention.

With these methods of protection and by other means—some of which are very

Photo: Riley Fortune, F.Z.S.

The Partridge is not very fond of water, but prefers to take its bath in a flutter of dust.

ingenious—the number of partridges in areas suitable to their well-being has been increased in a remarkable manner. One keeper's method was to pick up eggs from the outlying parts of the estate and from all tem, but one entailing much greater trouble and expense, is that which involves the substitution of dummies for real eggs up to the time when the sitting period is nearly over, the eggs meanwhile being brought along

Photo: Riley Fortune, F.Z.S.

When Partridges "pack" they appear to elect a leader, presumably the oldest and most sagacious cock-bird among them.

dangerous places and use them for making up other nests to their full complement. A partridge often lays fewer eggs than she could hatch, and therefore, if left to her own devices, may hatch fewer chicks than she is capable of rearing. The dummy-egg system, which consists of removing the partridge's eggs as they are laid, and replacing them with sham ones until the bird begins to sit (when the real ones are again restored), is another development of the "making-up" plan, the additional eggs being added, if necessary, to make up the full clutch so soon as the bird has finished laying.

A still further improvement on this system, but one entailing much greater trouble and expense, is that which involves the substitution of dummies for real eggs up to the time when the sitting period is nearly over, the eggs meanwhile being brought along under hens and replaced when on the eve of hatching. By this means the risk of loss through any sort of accident is reduced to a minimum, for with eggs taken up each day as laid and not returned until almost hatching, only a few hours will elapse before the bird is safely away with her brood.

Partridge preservation, whatever methods may be employed, is not open to the same condemnation that pheasant-rearing sometimes receives, though be it said that these strictures are usually forthcoming from those who understand the subject least thoroughly. Pheasants, when not too numerous, are useful to the farmer, for they destroy large quantities of wireworm and other noxious

insects, but the partridge not only does a great deal of good in this direction, but also feeds very largely on the seeds of weeds, and so helps the farmer more than he knows. Both partridges and pheasants may at times consume a certain amount of grain, though the former, probably, will never take as much as the latter. There can be but little doubt, however, that the price exacted in this way is a low one when the other side of the account is taken into consideration. There is also this to be said—that where grain through careless sowing is left exposed, it would certainly be picked up by birds of some sort even were there no game in the district. Standing corn, also, is mostly out of the reach of partridges, though it may be that when it is badly "laid" by rain and wind, the birds will take their toll. It is fair to conclude, however, that the bulk of the grain consumed by game-birds consists of that which falls to the ground at harvest time, and to this they are surely welcome, seeing that in any case it would be wasted.

The red-leg, French or Guernsey partridge is a different bird altogether from our native species, though it has much in common with the English bird. It is doubtful, however, if it would ever have been known in this country had it not been artificially introduced. The first attempt to naturalize the red-leg was made in the time of King Charles II., but was unsuccessful. Later, about one hundred and twenty years ago, it was re-introduced, and very soon made itself at home; now it may be found over a large part of England from the southern counties to Westmorland, though it is still far more rare than the common grey partridge. The latter is found all over Europe and beyond, and therefore probably enjoys the widest natural range of any non-migratory sporting bird. The red-leg, on the other hand, though found in many parts of the Continent, is a much more local bird—a characteristic which is to be noted even in this country.

It is more brightly coloured than the common species, and is easily distinguished by the strongly barred markings on the breast and the bright red legs. The call-note, too, is more musical. It is fleet of foot, and will run for some distance before taking flight, and is altogether more wild in habits, choosing to live on sandy soils and dry commons rather than on cultivated lands about the farmstead. In districts where they overlap, however, both species may be found nesting close together, and the eggs of the two have not infrequently been found in the same nest; while, as may often be noted, the coveys appear to fraternize quite peacefully.

Photo: Riley Fortune, F.Z.S.

The French, or Red-legged, Partridge is altogether different from our native species, but the coveys appear to fraternize quite peacefully.

Photo: Stanley Crook.

The Swift is seldom seen upon the ground. Owing to its long wings it has sometimes difficulty in rising from a level surface.

38.—THE SWIFT

By A. LANDSBOROUGH THOMSON, O.B.E., D.Sc.

THE swift is frequently confused with the members of the swallow family—to which a separate chapter in this work is devoted—but it is in reality a quite unrelated species possessing certain superficial points of resemblance due to adaptation to a similar mode of life. Like the swallow, the swift lives on insects caught in flight, and to this end has a small beak and a wide gape, a rather elongated body, and long narrow wings. Like the swallow also, it is purely a summer visitor to this country, and indeed necessarily so in view of its diet.

We have in the case of the swift and the swallow an excellent example of what is called "convergent evolution"—two unrelated species tending to approach each other in certain respects owing to the fact that similar habits have necessitated similar adaptations of form. The underlying structures upon which these adaptations are superimposed, however, are widely different in the two cases, and the more fundamental characteristics indicate an absence of close kinship. Questions of internal anatomy need not be discussed here, but there is one external feature which is of interest. The swallow and its kin belong to the great natural order of the perching birds, which includes the majority of the most familiar birds of the countryside—all the "song birds," and some less musical families such as the crows—and which is characterized by a special arrangement of the toes. In these birds each foot has three toes in front and a long hind toe, and there is a muscular arrangement which ensures a particularly good grip of a branch or wire in the act of perching. The swift, on the other hand,

has a quite different and very unusual kind of foot—four short toes, all pointing forward—which is of no use for perching, but is well suited for clinging to the irregularities of vertical surfaces.

Even in a superficial way, however, the swift is not so swallow-like as the casual observer is often inclined to suppose. It is a bigger and heavier bird, and has relatively longer and markedly curved wings, while the plumage is dark all over except for a light patch on the chin. The flight, too, is even more rapid and much more sweeping, while the well-known shrill scream replaces the twittering notes. In nesting habits, also, there are notable differences.

The swift is rather late in its arrival for the summer, the first half of May being the usual time of its appearance in this country. It may be observed, too, that all the birds of a colony appear to arrive almost simultaneously—one day there is none, and the next day they are in full force—but one locality may nevertheless receive its quota as much as a week later than another in the same district. With almost equal abruptness the swifts leave us again at the first approach of autumn, in fact, usually before August is out. In winter the species reaches South Africa, but to what particular region the birds from this country go is not yet known with certainty. Marked birds, however, have been recorded as returning to their native localities here in subsequent summers.

The time available for the nesting duties of the swift is obviously short, seeing how late the birds arrive and how early they leave, and it is not surprising that only one brood is usually reared in a season. The eggs are laid about a month after the birds arrive, and are incubated for eighteen days, and the young remain in the nest for a further six weeks. Migration, therefore, has to be undertaken very shortly after the young are on the wing. Occasionally a second brood is attempted, but it is then apt to be abandoned by the parents under the irresistible urge of the emigratory instinct.

The birds nest together in small colonies, and the nesting sites are crevices under the eaves of houses, in church steeples, or in the walls of ruined castles. Occasionally holes in cliffs or in trees are resorted to, and they must, indeed, have been quite commonly used in the days before human activity had created the sites now favoured. Suitable holes are not always obtained without a struggle with other birds, and with its short but powerful legs and sharp claws the swift will do battle even with the strong-billed starling; sometimes the birds fall to the ground locked in sanguinary combat. The nest itself is made of straws and feathers gathered in the air, and these materials are cemented together by the addition of the glue-like salivary secretion of the birds. This last habit reminds one that the esculent swifts of the East make their nests almost wholly of this substance, and so provide the birds'-nest soup of the Chinese. The eggs, usually two in number, are white in colour, rather rough in texture, and of an elongated oval shape; as we have said, they are incubated for about eighteen days. The young are at first blind, naked and helpless, and they do not leave the nest for the air until they are six weeks old.

Photo: Peter Webster.

The Swift is distinguished from members of the Swallow family by its dark plumage and by the longer and markedly curved wings.

The swift is surely the aerial animal *par excellence*. For velocity and duration of flight it is unrivalled, and its maximum speed is probably well over a hundred miles an hour. No other bird could hope to overtake it in the air, and its worst enemies are, indeed, the small parasites which infest its plumage. It is extraordinary how much of the swift's life is spent in the air, and how many of its activities the bird performs during flight. Swifts obtain their food on the wing, they gather nesting material on the wing, and they feed their young on the wing, and all their spare time seems to be spent in chasing each other in wide circles round the house-tops, loudly screaming the while, or in soaring at a great height. A wonderful impression of power and vigour is conveyed by the sight of these evolutions, and the effect is heightened by the almost startling scream. Bad weather does not daunt them, and, indeed, they seem to revel in a storm.

A Swift entering its nesting hole.

The so-called "night-flying" of the swift is also very remarkable. As the summer evening draws to a close the birds of a colony—probably only the males—may sometimes be seen rising higher and higher in the air until they are lost to sight against the darkening sky. Nobody has yet observed them returning to the nesting holes after this, and some have therefore been bold enough to suggest that the birds spend the night in the air, sleeping as they soar. It is equally true, however, that nobody has seen the birds descend in the morning, so that the alleged feat must be regarded as still unproven.

Photos: Alfred Taylor.

The feet of the Swift are so made that it is unable to perch, but they are well adapted for clinging to the irregularities of vertical surfaces.

Some discussion has taken place as to whether the swift can rise from level ground, and it is certainly true that it very seldom alights upon it of its own free will. It is beyond dispute, however, that a swift can rise from the ground if need be, despite its shortness of leg and great length of wing. The present writer has twice seen this happen, once from the carpet of a room and once from an almost level lawn, when a bird had been caught indoors. In each case the bird was placed gently on the ground, remained motionless for a moment or two, and then launched itself into the air with a sudden effort and was in full flight after a couple of strokes. There are many other records to the same effect, and those to the contrary must therefore refer to injured or exhausted birds; it has been said, too, that the bird may become too cramped to rise if it be held on the ground for a short time before being released.

Photo: Stanley Crook.

A young Swift in a nest that was built under the tiles of a farm-house.

There are many species of swifts in different parts of the world, but the one with which we have dealt is the only regular British representative of the family. The Alpine swift is an occasional wanderer here, and is distinguishable by its larger size and light underparts. It is even more powerful on the wing than our own bird.

Photo: C. A. Booth.

The Blackbird is surely one of our finest songsters. Of all birds' notes his are, perhaps, most near to our own musical pitch.

39.—THE MOST BEAUTIFUL BIRD SONG

By AUDREY SETON GORDON, B.A., M.B.O.U.

IN the British Isles are found perhaps the finest songsters of the whole world. Many a bird lover from distant countries journeys overseas to hear them ; among the number was the late President Roosevelt, who was conducted through the New Forest by that distinguished naturalist, Viscount Grey of Fallodon. Roosevelt was not at the time familiar with some of our most celebrated bird songsters, and he heard with delight that wild sweet music that is at its best in such secluded woodland places.

What is a bird's song ?

The language of birds consists of four varieties of sound, each with a distinct meaning. Firstly, there are the true alarm notes ; I think it may be safely said that all birds possess some kind of alarm cry. Even those birds of the wide spaces of the ocean —the quiet, flying fulmar petrel or the consequential puffin—which are usually so silent, do at times utter an alarm note under great emotional distress.

Secondly, there are the call notes, a step higher in bird voice-production. These call notes may be either simple one-syllable sounds, or more complicated, and may express a wide range of feelings.

Thirdly, comes the " travel talk," a language different from the call notes. It is used only on migration, and is therefore rarely heard.

Fourthly, there is the song proper.

There are some ornithologists who maintain that birds' songs are composed entirely of elaborated call notes and imitations of other birds or sounds in nature, such as running water. Personally, I believe that the higher forms of song have been evolved quite independently of call notes, and are the emotional expression of the joy of living. They are not entirely even mating songs.

Call notes vary little among individuals of a given species, whereas the actual song varies markedly, sometimes enormously, with each songster. This would scarcely be the case were the song composed entirely of the call notes.

Songs attain their most complicated and diverse forms among the so-called passeriform birds, which are structurally the most highly developed. One of their characteristics for classification purposes is that they must have at least five pairs of voice muscles.

In this class are almost all of the "small birds" of Britain—thrushes, blackbirds, warblers, robins, larks, pipits, wagtails, finches, tits, swallows and others. But although these songs are the most elaborate in the bird world, they are not necessarily the most beautiful or the most musical.

I suppose the average person, when asked what he considered to be the most beautiful song, would unhesitatingly say either the nightingale, the skylark, or the thrush.

With poets the nightingale has from earliest times been supreme. Its song is certainly hauntingly beautiful, especially when heard in the stillness of a hot summer's night. Then the absence of competitors and the natural beauty of the setting lend full value to the rich, liquid notes that pour in measured cadence from the throat of the unobtrusive little bird. The nightingale sings also during the day, and even in the surge of song that rises in springtime from every wood and copse his voice rings out clearly from the rest.

There is one bird, perhaps—the blackcap—whose song, though much less celebrated and less intensely emotional, is to my mind of greater musical beauty. This must, however, be admitted to be a purely personal opinion. Gilbert White has described it as "a full, deep, sweet, loud,

Photo: G. A. Booth.

There is something pathetically beautiful about the high-pitched gentle little song of the Willow Warbler.

wild pipe . . . superior perhaps to that of any of our warblers, the nightingale excepted." W. H. Hudson, in quoting the above, says that after reading such a description it is a disappointment to hear the song.

Photo: Stanley Crook.

Though less intensely emotional, the song of the Blackcap Warbler is thought by some to rival that of the Nightingale in beauty.

He agrees more with John Burroughs, who, in his observations on British song-birds, describes the song as follows: "I recognized the note of the blackcap by its brightness and strength, and a faint suggestion in it of the nightingale's; but it was disappointing; I had expected in it a nearer approach to its great rival. . . . It is a ringing, animated strain, but as a whole seemed to me crude, not smoothly and finely modulated . . . its song is silvern, not golden." "This," remarks Hudson, "is on the whole a very good description, but I should not say that the blackcap's song is crude, however wild and irregular it may be; nor that there is in it even the faintest suggestion of the nightingale's."

A curious point about the nightingale is its restricted range. In the British Isles it appears to be heard only in the south and east of England, though there are signs that it is gradually spreading farther west. In Scotland it is now unknown, although at one time it must have been plentiful, for in the old Gaelic stories it goes by the picturesquely symbolical name of "the Rose of Music."

In listening to bird song, there is no doubt that one is influenced considerably by setting and conditions. The skylark, as a songster, is a universal favourite, but would his song seem so ecstatic if it came from out a dark wood? Does not the enchantment lie in the way it is poured out of the very sky?

Higher still and higher,
From the earth thou springest,
The deep blue thou wingest,
And singing still dost soar,
And soaring ever singest. —SHELLEY.

The character of the skylark's song is essentially that of joyousness. As the nightingale can hardly fail to awaken the emotions—the intensity of rapture being sometimes almost more than one can

Photo: A. Brook.

THE CURLEW.

It is during the nesting season that he sings his full song, and in this case, unlike other songsters, the hen sings equally well.

bear—so the lark can express nothing but joy, so full it is of life and the spirit of spring and the freedom of wide, open places. Yet it cannot be said to be really musical—as that term is usually understood.

The Missel Thrush and Blackbird

For a really beautiful song suggesting deep emotion it is hard to beat the short, simple song of the missel thrush. Perhaps again one appreciates it more for the fact that it is heard in early spring, when few other birds are singing. It comes as a réveillé to Nature after her long winter's sleep, and speaks of hope and of the promise of the year.

The blackbird, too, is surely one of our finest songsters. His is a short, sweet melody, sung in whistling phrases, and perhaps most near of all birds' songs to our own musical pitch; for his intervals can often be reproduced on our musical instruments. The performance of the song thrush, too, is much admired. The song consists of short phrases, whistled or "spoken," and usually repeated two or three times, but it does not rival the musical refrain of its cousin the blackbird.

There is something pathetically beautiful about the high-pitched, gentle little song of the willow warbler and the rapturous trilling of the wood warbler. They are so small, and, watching them sing, one can see their whole energy poured forth in the expression of their joy and thankfulness. But such songs, which are repeated time after time, and vary little in different individuals, cannot give us so much pleasure as those of the nightingale, skylark, blackcap, missel thrush and blackbird.

There is one bird, however, to which this does not apply, and whose song, repeated time and again and with little variation in individuals, can never pall. This bird is not even a passeriform—it is a wader, the curlew, or "whaup," as he is called in the lowlands.

The curlew belongs to the plover tribe, and again the peculiar value of his call is due in part to the circumstances in which it is heard. He frequents the rough moorland and hilly parts of the British Isles during the breeding season, and passes the winter by the sea somewhere to the south of his nesting grounds. It is during the nesting season that he sings his full song, like most other songsters, but in this case the hen sings equally well. The song begins in a low key, each note being a long-drawn-out whistle, and each succeeding sound is slightly higher and less drawn-out, and the interval between each note—never at all great—a little less, the notes coming a little quicker after each other, till perhaps the last five are almost the same pitch, the volume of sound gradually dying away. It is uttered on the wing, the bird gliding downwards with wings motionless as it sings. Very often the curlew will go round in a wide circle, alternately flying upwards, then planing downwards singing, the full song being introduced after a few preliminary low notes.

The Most Appealing Song

No one who has witnessed and listened to this performance can ever forget it. Yet among the people of the moorland places the curlew is considered to be a bird of bad omen. The usual Gaelic name for him signifies "wailing music," but other names mean Wail of Warning, Wail of Sorrow, Death Cry, and it is thought to be one of the dreaded Seven Whistlers.

No doubt the cry of the curlew is a melancholy sound, yet it is so much in keeping with the wild loneliness of the moorland solitudes that it has for me and many other lovers of wild nature quite the most appealing song of all, for as Fiona Macleod wrote: "It has the same entrancing call that the wind has at night, or that the sea has—it calls us to the Wild."

Wild Flowers and Their Ways

16.—WILD FLOWERS AND THEIR COUNTRY NAMES

By G. CLARKE NUTTALL, B.Sc.

With photographs by the Author

OUR wild flowers own all manner of quaint and curious names that have been given them, through centuries past by the countryfolk. These names, even when they seem meaningless to us nowadays, always have some reason behind them. Thus the monkshood has many names. Sometimes it is called "blue rocket," because of its tall spike of blue flowers; or "bearsfoot" from the shape of its leaf.

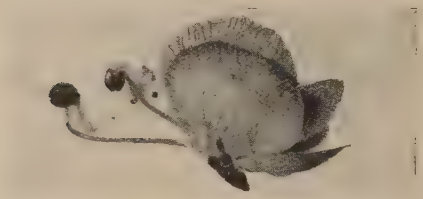
Monkshood or "Blue Rocket."

Monkshood as "Helmet Flower."

"Helmet flower" is a particularly suitable name since its flower, in profile, is just like a helmet. If the top blue petal be drawn back a little, two quaint objects—nectaries on long stalks—spring into view like two stooping old people coming out of a little house, hence the plant's names of "Adam and Eve" and "Noah's Ark."

Monkshood as "Adam and Eve" and "Noah's Ark."

After pulling off the top blue petal turn the remainder of the flower sideways as in the picture here and it forms the daintiest



Monkshood, as "Venus's Chariot" drawn by two "Doves."

Monkshood as "Auld Wife's Hood," and "Grannie's Night-cap."

fairy chariot, which has caused the country folk to call it "**Venus's chariot drawn by two doves,**" or "**Venus's chariot,**" or "**Jacob's chariot,**" or "**Venus's doves.**"

If the top blue petal be pulled off one can easily see why the plant is called "**monkshood,**" "**auld wife's hood**" and "**grannie's night-cap.**"

So there is a reason for every name by

Dandelion showing the great jagged teeth of the leaves—"dents-de-lion."

Dandelion as "Swine's Snout."

Dandelion as "Priest's Crown."

which country folk and country children know the plants.

The name dandelion is derived from *dents-de-lion,* and refers to the great jagged teeth of the leaves, which resemble the teeth of a lion. The "lion" idea is carried a stage farther in the tawniness of the flowers and their fanciful reminder of a lion's mane.

Dandelion as "The Clock" or "Blowball."

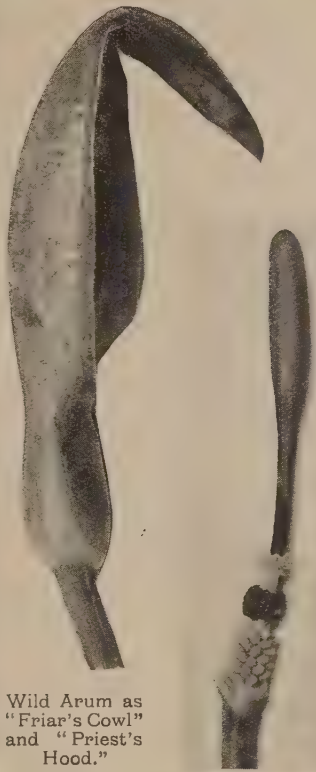
To its feathery ball of fruit is due the plant's name of "**the clock,**" because one tells the hour by seeing how many puffs of breath it takes to set all the little fruits flying on their dainty parachutes.

Other country children call it the "**fortune teller,**" because suitable questions of fortune can be veraciously answered in a similar manner. A third and quite common name is the "**blowball.**"

The name of "**swine's snout,**" heard in some parts of the country, comes from the remarkable resemblance of the unopened buds in the spring to the snout of a pig, even to the "turn-up" at the end.

"**Priest's crown**" is an old countryside name. When all the feathery seeds are

Wild Arum as "Parson in a Pulpit."



Wild Arum as "Friar's Cowl" and "Priest's Hood."

Wild Arum as "Lady's Finger."

blown away, the bare white end of the stalk with its bits of dead brown scales straggling all down is ludicrously like a bald head with wisps of hair, and hence to the tonsured head of a priest. The name no doubt goes back to the Middle Ages.

The wild arum has a fleshy column with a long rounded head peeping out of an enfolding green leaf. So country children call the plant "Jack-in-a-box," "parson in a pulpit" and "priesties." Sometimes these heads are dark, sometimes light in colour, so it is also called "lords and ladies" (perhaps its best-known name), "Adam and Eve," "cows and calves."

Because this column is rod-like, the names "schoolmaster" (obviously in a desk) and "Aaron" have been given.

When fertilization is completed among the little flowers at the base of the column, the big green leaf ("spathe") withers and falls over as shown in the picture. Its appearance then has given the plant its old names of "friar's cowl" and "priest's hood." No doubt these names go back to the days when priests and monks were common features of the countryside.

"Lady's finger" is a name given because each column wears a ring—that is, the dark staminal flowers form a band round the base of the column.

Some plants have earned their popular names from a quaint resemblance to birds, animals, etc.

The picture below is not a group of fluttering doves; it is the flower (with the stalk cut out) of the columbine. But the photograph clearly shows how the plant got its name, *columba* (Latin) = a dove.

The yellow toadflax is so called because the shape of the mouth of the petals recalls the great mouth of a toad.

The individual flowers, detached from the stalk, are also very like tadpoles.

Other names of the plant are "eggs and

Columbine—*Columba* (a Dove).

The mouth of the petals of Toadflax resemble the great mouth of the Toad.

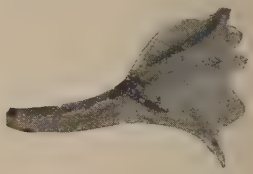
Larkspur or "Knight-spur."

Toadflax flowers as "Tadpoles."

bacon" and "butter and eggs," from the orange and pale yellow colouring of the petals.

The larkspur owes several of its homely names to a thin honey tube which projects a long way behind the flower and which consists of a spur from a petal enclosed within a spur from the green calyx. Country folk have seen in this a resemblance to the long delicate spur or heel at the back of a lark's claw, so the plant became "larkspur" or "lark's-heel" (a very ordinary name in olden days, when it was commonly written "larkesheele"), or sometimes "larkstoe" or "lark claw." "Knightspur," an interesting old name, is due to the resemblance to the spur of a knight, and the allusion reminds us that it has come down from days when knights on horseback were often seen in the country roads. The Latin name *delphinium** is due to the fact, as an old writer explains, that "the flowers and especially before they be perfected have a certain shew and likenesse of those dolphins, which old pictures and armes of certain antient families have expressed with a crooked and bending figure or shape, by which sign also the heavenly dolphine is set forth."

Larkspur or "Lark's-heel."



Larkspur—"Delphinium" (Little Dolphin).

Daisy—"Day's Eye."

The daisy's name is singularly charming and apposite, the round centre and white surround being like the pupil and white of an eye, and its opening at dawn and closing at nightfall marking it out as the "day's eye."

* Lat.: *delphinus* = dolphin.

Photo: R. Kearton, F.Z.S.

In summer, when the Squirrel's coat is at its reddest, the tail is moulting and is but a shadow of its true self.

14.—THE LITTLE RED SQUIRREL

By CHARLES S. BAYNE

WE call it the red squirrel to distinguish it from the larger grey squirrel which is not indigenous to this country, but has been imported and liberated in a number of districts by unwise enthusiasts. Common squirrel would be a better name for our native species, because the word "red" describes it only during part of the year, and that the summer, when, owing to the thickness of the foliage and its strictly arboreal habits, it is less frequently seen than it is earlier or later. In autumn and winter it spends much of its time on the ground rummaging among the dead leaves for fallen nuts, and it may be observed almost any day wherever there are suitable woods. But then it is a brown animal.

The fact is, that the squirrel moults twice a year. It begins to change into its winter coat about the middle of August, and when this is completed, about half-way through October, the animal is at its very best. Its fur is then long and soft on both body and tail, and greyish-brown in colour, and its ears are decorated with long tufts of brown hair. Almost immediately deterioration sets in; indeed, it is possible that at no time in its career does the squirrel have a perfect coat. For no sooner has the tail acquired its new fur than it begins to fade, and as the tail is the first part to be re-clothed, this may happen before the body fur is full grown. At any rate, the tip of the tail is quite noticeably faded a week or two after the autumn moult is completed, and as the days pass and the season changes

to spring and then to summer, the fading extends and becomes more and more pronounced till, about June, the whole tail is almost white. What is more remarkable is the fact that while the body coat moults again in May and is replaced by a short, coarse, red fur, the tail and the ear tufts are renewed only once a year, and as the summer advances they not only bleach whiter but also become thin and scraggy. So when the squirrel is the " red " squirrel, its tail, which is its most characteristic feature, is but a shadow of its true self.

Significance of the Tail

The tail is of so much importance to the animal that this special arrangement of its moulting must have some significance. When the squirrel is sitting he holds his tail in a beautiful curve over his back, and it is then exquisitely decorative and charming. But when he is running along a bough he carries it behind him ; and if you watch him carefully as he goes, you will notice that he moves it now this way, now that ; now up, now down. It serves him as a balancing pole ; and as it acts instinctively he is never in any danger of losing his equilibrium, and may devote his whole attention to his progress and to a quick study of the surrounding boughs. When he springs from branch to branch, and especially when he leaps from one tree to another, he gives his tail a downward jerk, which, no doubt, adds the extra ounce of momentum necessary to carry him to his objective. It is worth notice that he never overshoots his mark, but, as a rule, judges his distance so well that he alights with hardly an inch to spare, but with plenty to allow his four feet to grip the new branch. When he is being hunted he sometimes, in his terror, takes greater risks ; and on such occasions I have seen him fall short and drop twenty or thirty feet to the ground. But he is so light and so skilled in jumping that he seldom if ever suffers harm from such an accident, but at once scampers off and scrambles up the other side of a tree to safety.

But in all these uses the bare tail would serve him well enough except in the matter of decorative effect. It is believed by many naturalists that the tail acts as a plane when the squirrel jumps, and so simplifies his progress from tree to tree. But if this were so he would have to adjust his leaping to its thin and scraggy summer condition, and there is no evidence that he does this. The tail, however, has one definite use which fully accounts for its peculiarities. When the squirrel curls himself up to sleep he wraps it round him. So it is a blanket which is thick and warm for winter and is thinned out to suit the milder temperature of summer.

It is said that the name squirrel is a corruption of a Greek word *skiouros*, which means shadow-tail. That is a very pretty idea ; but, unfortunately, the tail of a squirrel is not by any means shadowy except for a few weeks in summer, when, as I have already said, it is a shadow of itself. Etymologists, however, are not necessarily naturalists, and it is probable that those who derived this word for the dictionaries had no intimate knowledge of squirrel life. In that case they would not be likely to have heard the alarm call of the squirrel, which is a long-drawn *skee-ow-w-w*. That note must have been familiar from the earliest times to all forest-living people, and it is quite likely that the animal would come to be known to some tribes as the " skeeow." You have only to add to that the Greek termination *os* and slip in an *r* for euphony and you have the Greek name. That may be only a coincidence, but if it be the truth the squirrel's name is really a corruption of the creature's own alarm call.

A more familiar squirrel sound is the common *chuck*, which, besides serving as an occasional call between one individual and another, is also used extravagantly for the purpose of scolding intruders.

Strategy of the Squirrel

The average human being who goes through a wood sees very little of the squirrel even where the animal abounds, partly because of his own noisy progress, which gives warning of his approach to all wild creatures long before he comes within sight of them, and partly because of the simple trick by which a squirrel can disappear. When a squirrel which happens to be on the ground hears or sees any sign of danger, it at once makes for a tree. The inexperienced observer who may catch a momentary glimpse of a streak of brown fur and mark

Photo: Stanley Crook.

AN ALARM.

When a Squirrel which happens to be on the ground hears any sign of danger, it immediately makes for a tree, climbs up a few feet, and remains perfectly still until the enemy is gone.

where it vanishes, and who knows from books that squirrels climb, very naturally looks up when he reaches the tree expecting to see a delightful picture of the charming little creature sitting up on a branch beyond danger of capture. But when he discovers no trace of it anywhere he thinks his eyes have deceived him for the first time in his life, and passes on disappointed and wondering. And as he goes the squirrel watches him from behind the trunk. For the squirrel, like other wild creatures, knows that the safest policy in face of danger is to keep out of sight and remain perfectly still. So he first places a tree between himself and the approaching enemy, then climbs up a few feet and clings to the trunk with his legs spread and his body and tail pressed close to the bark. There he remains, as a rule, till the danger is over, edging round a little if need be to keep himself under cover when the intruder passes.

Photo: R. Kearton, F.Z.S.

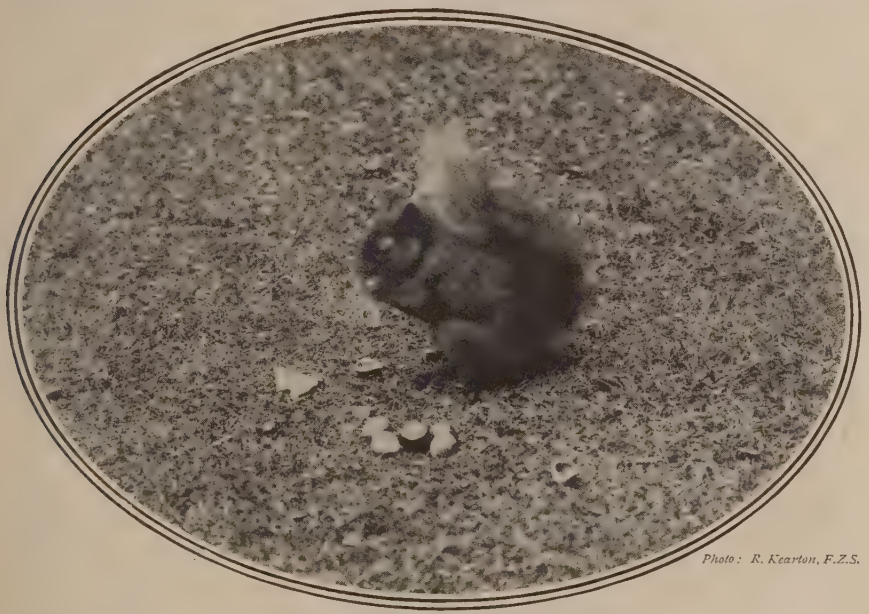
When safely out of reach the Squirrel will announce himself by scolding volubly, and he will continue to scold until the enemy is gone.

Nevertheless, it is quite easy to watch the daily life of the squirrel if his own tactics be adopted—that is, to remain still. We read much of the great value of scent as a warning to wild creatures, but so far as our British mammals are concerned, my experience is that sound and movement are far more important. If, instead of passing, you stop before the tree behind which he is hiding and wait, the squirrel will presently climb up to the first fork to scout. Then the slightest movement will betray your presence to him, and the squirrel thereupon will announce himself by scolding volubly. But if you stand rigid he may not notice you, and will soon become reassured and proceed with his interrupted pursuit, whatever it may have been, whether feeding, storing, or attending to young.

If he should notice you, however, he will scold until you leave, or if you insist on waiting he will become really alarmed and will climb to some safe retreat in the thick top of a tree. But if there are two of you and one goes away noisily, the squirrel will forget about the other. Apparently in such circumstances he is unable to count two. I have had this experience several times, and in one instance the squirrel so far recovered his nerves as to come back to where he had been feeding, which was within a few feet of me, actually turn his back on me and give me a lesson in the gentle art of eating hornbeam seeds.

When the squirrel is feeding on hazel nuts he sits upon his haunches, and holding the nut in his fore-paws—which are practically hands—he nibbles a hole in the tip. Then he inserts his long incisors and splits the shell in halves or breaks it bit by bit till he can get at the kernel. In this he differs from the dormouse, which invariably begins at the base of the nut. Besides nuts he eats a variety of other things. A great favourite of his is a pine cone. This he holds horizontally between his hands and, revolving it quickly after the manner of a lathe, strips the scales from it with his teeth and snaps

up any seeds that may remain under them. He also eats beech-mast, acorns, hornbeam and other seeds, various fruits and toad-stools, and in spring renews his strength with the opening buds of larch and other trees. When feeding on larch buds he seems to prefer those at the very tip of a branch, and will reach out perilously to obtain them. Unfortunately, he is sometimes guilty of robbing birds' nests, both of eggs and young. In dry summers he does much damage in pine woods by stripping a ring of bark from the stem of a young tree in order to get at the sappy wood underneath. The effect of this is that the leading shoot dies and the tree is ruined.



When feeding upon hazel nuts the Squirrel sits upon his haunches, and holding the nut in his fore-paws nibbles a hole in the tip.

In autumn he feeds on fat-forming nuts and so prepares himself to face the winter. But, in this country at any rate, he does not hibernate in the real sense of the word. He sleeps longer, it is true, than he does in summer, but that is largely because the nights are longer, and in very hard weather he may perhaps spend a day or two on end in his nest. I have seen him abroad on most days, even when there was snow on the ground. Apart from this evidence, however, we know from his autumn preparations that he expects to be not only awake but active in the winter months, for he lays up stores of nuts, one in his winter nest and others in convenient holes. In addition to these collections, he hides many individually by burying them in the ground. The probability is that he does not remember where he puts these separate nuts, but is able to find some of them later by scraping in likely places.

Further evidence is the fact that, in the south of England at any rate, squirrels are paired in February and sometimes even in January, that is, in the very depth of winter. About this time the families, which have kept more or less together during summer and autumn, scatter, the elders driving off the young to seek quarters of their own. Each male selects a territory and shows fight to any male intruder of his own species. Then the important business of nest building is begun. The male takes a share in this work; but I am not sure whether, as is the case with many species of bird the

female actually carries out the construction of the home, while the male only helps to gather the material. This consists largely of sticks, moss, strips of bark and dead leaves. I have seen a squirrel's nest composed almost entirely of strips of bark. The "drey," as it is called, is a globular structure with the entrance in one side and is lined with dead leaves, so it makes a very cosy nursery for the babies when they arrive. It is usually placed high up in a fork of a tree, but I have found one built on an old pigeon's nest far out on a long branch. For some reason best known to themselves, a pair of squirrels will sometimes make several nests before they complete one that satisfies them. They are as cautious as birds about approaching the drey, especially when there are young in it. They will climb up past it as if it meant nothing to them, and, sitting in the branches above it, will survey the land carefully. Then if they see no suspicious movement they will descend to it and enter.

Photo: R. Kearton, F.Z.S.

When the Squirrel is sitting he holds his tail in a beautiful curve over his back, but when running along a bough he carries it behind him.

The young are born in March or April. As a rule, there are two or three of them, and they are blind and naked. In a few weeks, however, they can come out and take short trips among the branches. They are still fed by the mother, who brings them titbits in her mouth, and when they have gained confidence she teaches them the important art of jumping. At first they are as unwilling to take the risk as a young bird is to fly, but after the mother has demonstrated several times what she wants them to do, first one and then another ventures, the mother bristling with pride as she watches their success. Thereafter they are led on still more daring adventures, learn the best routes by which to pass from one tree to another, and when they are six weeks old they are able to take care of themselves.

In their ordinary daily activities squirrels follow definite routes among the branches of the trees. They must work these out for themselves and then remember them. Possibly scent aids them in this; but even in strange quarters their judgment of branch "country" is marvellous. At first sight their progress may seem to be more or less haphazard; but it would never do for a squirrel when fleeing from danger to reach the end of a branch and then have to retrace its steps to the trunk and try another in the hope of finding a better chance of escape to the next tree. Careful observation shows that in passing across a tree to reach another a squirrel always goes by the most direct route to the tip of the branch that gives it the shortest jump.

Life of the Sea Shore

1.—LIFE IN A ROCK POOL

By DR. FRANCIS WARD, F.Z.S.

THE summer holidays had really come, and the whole family were off to the sea. Next morning at the station the platforms were crowded, and judging by the display of nets and spades, the rest of the world was also going to the sea. How hot and stuffy it was in the train, with scarcely room to move; but just when everyone felt at one's worst, all thoughts turned to that lovely bay—the glittering yellow sand, the green-blue breakers which bubble into pearly foam on the shore—and the scrambles among the rocks.

It was late when the family arrived, but tired as they were, they had to go and see if the cliffs, the rocks and the sea were still there.

Photo: F. Martin Duncan, F.Z.S.

The Common Star-fish may sometimes be found alive at a low-water mark. It has five thick, strong fingers, with a groove underneath, and in this groove are its tube-feet, which are similar to the tube-feet of the sea-urchin.

Next day opened as a glorious morning, and as soon as possible the family were on the beach. Luck was with them, for the tide was going out; in front was a great stretch of yellow sand with pools here and there left by the receding tide; on the right the white cliffs were bathed in sunshine, and down below were great weed-covered boulders, which certainly meant deep rock pools. They had not gone far when on the sand they found a dead common star-fish (*Asterias rubens*), familiar to all who have been by the sea. You can find this star-fish alive on the low-water mark, but as a rule he lives farther out to sea.

The common star-fish has five thick, strong fingers, rough to the touch, and of an orange colour. A groove runs the whole length on the under-surface of each finger, and in this groove are the numerous tube-feet. These are hollow, semi-transparent organs with a circular sucker at the end, similar to the tube-feet of the sea-urchin, illustrated in the group of four kinematograph pictures on p. 784. These tube-feet can be extended or contracted at will; for in the star-fish there is a water-vascular system connected throughout the body and the fingers. To extend the tube-feet the sucker ends are closed, and the water, being forced into the hollow part, causes

them to elongate ; when the fluid is allowed to escape the tube-feet collapse, shrink right up, and disappear from sight.

By means of these structures the star-fish can cling to a rock or move about ; when he moves he extends his tube-feet and takes hold with the sucker, then pulls himself up to his point of attachment. The feet individually are very delicate structures, but the combined hold of numerous tube-feet enables the star-fish to take a tremendous grip of a rock under water, and considerable force has to be used to pull him off ; not infrequently in doing so several of the tube-feet are torn away.

The alimentary tract terminates in a minute aperture in the centre of the back, and the mouth is exactly opposite this aperture on the underside of the body. This mouth is a circular opening with a thick membranous lip. Just under this lip are five triangular cutting teeth, the points of which meet in the centre of the mouth. The star-fish mainly feeds on mussels ; it opens the mollusc in the following manner. He stands up on the tips of his fingers, the tips being quite close together so that this echinoderm has the appearance of a half-opened umbrella. The mussel is drawn up right to the top against the mouth. The fingers now contract together and a continuous steady pull is exerted on the shell. At last the mussel can stand it no longer, and opens, when the star-fish sucks out his well-earned meal.

After the star-fish had been examined the party scrambled over the rocks, which were covered by various shell-fish, all stuck down tight, so as to keep the moisture in their shells until the return of the tide. Everywhere were to be seen the most common of all the British species of sea-anemones (*Actinia mesembryanthemum*), and where these had been left dry by the receding tide, they had contracted into jelly-like masses, hemispherical or conical in shape, with a puckered hole at the top.

Photo from film : Dr. Francis Ward, F.Z.S.

A little farther along was a shallow pool containing anemones with their tentacles fully extended. The little girl is putting down a piece of meat—

A little farther along was a shallow pool containing several of these anemones with their tentacles fully extended which were of the same chocolate colour as the stem. When dry on the rock the anemones were by no means beautiful. Under water it was quite a different thing ; a faint azure line encircled the base, which displayed dark green lines converging towards the centre ; around the margin of the mouth there was a circle of azure tubercles, like turquoise beads of the greatest beauty, which are supposed to act as eyes. These can only be seen when the anemone is quite open. Every one of my readers can find this the prettiest and commonest of anemones anywhere round the coast. One of the party broke off a small piece of meat

from a sandwich and gently gave it to an anemone. This was at once seized by the nearest feelers, while the others round the other side seemed to quiver with excitement. The meat was carried right through the mouth into the stomach of the anemone, and then the tentacles partially closed while digestion proceeded.

Too much time had already been spent in feeding anemones, for the party wanted to get to the deep rock pool to search for the big pink and white sea-urchins (*Echinus esculentus*) which they had found there before. Surely, ahead of them was the big rock which marked their deep pool, so they scrambled on.

It was their pool, only more beautiful than ever! There was something mystic about it as they gazed into that under-water fairyland; seaweeds of every shape, size and colour grew from the walls, and that pool might have been bottomless, for right deep down where the sun failed to reach could dimly be seen dark green weeds intermingled with red. Where the walls were not entirely overgrown, red and white blocks of granite showed through, and as the sun lighted up the pool the translucent seaweed appeared to be growing from slabs of marble.

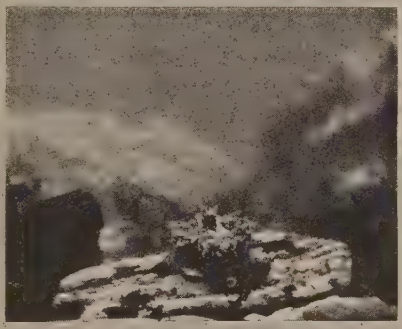
And all in that pool was absolutely still.

The beauty of the pool had held the party spellbound; but soon they began to look around, and right opposite, attached to the weed under a shelving rock, there was the echinoderm they had come to find—the edible common sea-urchin (*Echinus esculentus*). The tide had receded very rapidly and left this urchin high and dry, so that it could be seen how the tube-feet are stretched in holding it up, unsupported by the water. Farther along there was another, only some six inches under the surface, so one of the party lying flat down gently detached this specimen and brought him out.

A general search around was now made and several others—partially covered with weed—were spotted, and doubtless there were many more in that pool entirely hidden from sight.

Let us examine the specimen taken out of the pool. I have given a description of the star-fish with its five fingers and the groove along the under-surface of each finger filled with tube-feet, and the mouth in the centre of the under-surface. The sea-urchin is merely a transformed star-

-into the mouth of an anemone, which—



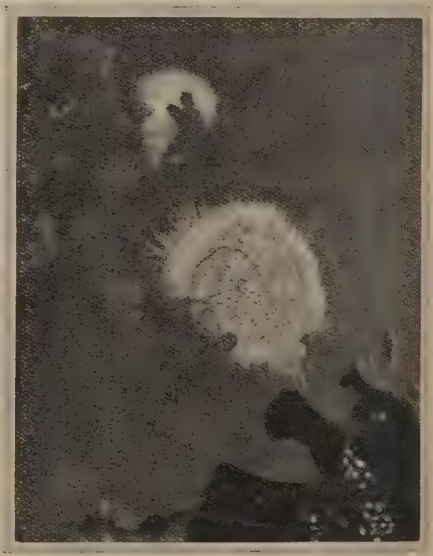
—eagerly seizes the tempting morsel and—

Photos from Kinematograph film: Dr. Francis Ward, F.Z.S.

—absorbs it, closing the mouth over it.

Attached to the weed under a shelving rock was the Echinoderm—the Edible Sea-urchin —merely a transformed star-fish, the five fingers of which have been bent over so that the points join.

1.



2

Photos from Kinematograph film: Dr. Francis Ward, F.Z.S.

(1) The Sea-urchin was placed on the sharp point of a rock; he took hold, but it was not to his liking, so he started to climb down, which he achieved eventually, and (2) commenced to cover himself up with seaweed—

—(3) and was soon almost hidden away; but he was dragged out of his hiding-place, and—

fish, the five fingers of which have been bent over so that the points join at the top. Thus the flat star-fish becomes the rounded sea-urchin.

It can easily be seen that the urchin consists of five segments which are the fingers joined together. With this bending over of a finger the under-surface of it becomes the outer surface of a segment in the sea-urchin ; thus the tube-feet on the urchin are arranged in five rows up the middle of each segment and radiate from the base to the apex. A row of tube-feet arranged in this manner is well illustrated in the first picture of the set of four kinematograph illustrations on p. 784.

The tube-feet of the sea-urchin are similar in general structure to those of the star-fish already described. The urchin has also a water-vascular system which operates in the same way, namely, by driving fluid into the tube-feet when they are required to extend. He moves in a similar manner, that is, by pulling himself up to the point of attachment of the extended tube-feet, but when doing this, because of his shape, he has a tendency to topple over ; this is prevented by the creature using his spines to steady himself. These spines have a considerable range of movement, and when the urchin is in a hurry he can scuttle along level ground by the use of them alone.

The spines on the urchin are mainly of two sizes, and consist of calcareous matter ending in a spear-point. The base of a spine is cup-shaped and rotates on a tubercle on the skeleton of the urchin. Though I have described how these spines assist the urchin to move, they are mainly for protection. Well do I remember this, for in 1915 my men and I used to bathe in the Ægean Sea off the shores of Gallipoli. The bottom swarmed with a small black sea-urchin, and as we waded in the spines of this specimen pierced the soles of our feet, and unless picked out in that poisonous place caused a sore. At first all paraded to have black spines picked out which had broken in, but later we bathed in our army boots.

To return to our party and the specimen we had gathered. This urchin was taken to a convenient shallow pool near by and held for a minute on the sharp point of a rock, where he took hold, but this was not at all to his liking. You can see in the illustration how he is pawing the water with his tube-feet on the right, so that he might get hold of something to enable him to climb down from his uncomfortable perch. Giving up this effort, he tried the

Photos from Kinematograph film: Dr. Francis Ward, F.Z.S.

—(4) placed in a pool where there were no weeds, only pebbles and shells, and with these he rapidly covered himself.

other side, where was a gradual slope to go down, and very soon he was hidden away amongst the seaweed in the pool. But he was dragged out again and now placed on the top of a large-leaved seaweed; in another illustration it can be seen how he is taking hold of the leaf and pulling it over himself.

Finally, we placed him in a pool where there were no weeds, only pebbles and

The hermit crab takes up his abode in various empty houses, but the whelk-shell is one of the commonest. The whole of the abdomen of this crustacean becomes soft, and is twisted round to fill up each whorl of the shell. By this means the hermit crab gets such a hold that it is impossible to pull him out without breaking his body.

Space is left for the crab to withdraw

Photos from Kinematograph film: Dr. Francis Ward, F.Z.S.

1. Common Sea-urchin climbing down the rock—his tube-feet extended to grip the rock by the aid of the strong suckers. (2) The tube-feet and suckers extended. (3) Another view of the same. (4) An enlarged view of the tubes and suckers, the adhering properties of which are enormous.

shells. Here he set to work at once and covered himself with these instead of with seaweed. *Echinus esculentus* was then released into his rocky pool; he went down to the bottom, and there he lay for some time, as if to say, "I am tired of this game." Suddenly he realized he was free, and in less than ten minutes was invisible.

Then began a search for more denizens of the pool, and presently on one side where the pool shelved down was a hermit crab emerging from a whelk-shell.

right into the opening of the shell when attacked. As often as not a hermit crab carries an anemone on the top of his house. This is a most convenient arrangement for both creatures—the anemone is able to sting the enemies of the crab and keep them away, while the crab, as he carries his house about with him, takes the anemone on to fresh feeding grounds. Sometimes the whelk-shell becomes absorbed, and then the anemone lies directly on the crab like a blanket.

Photo: S. Leonard Bastin.

The Gorse will not endure extremes of heat and cold, but grows well in the temperate climate of Britain. For some unexplained reason it is always at its best near the sea.

5.—THE STORY OF THE GORSE

By S. LEONARD BASTIN

ANY stranger coming to England for the first time would have small hesitation in deciding which should be the national flower. Australia picked the yellow wattle (acacia) as most typical of the island continent, and we should certainly have chosen the golden gorse, which is in most ways more characteristic of English climate and scenery than any other plant. This prickly bush, which displays such a wealth of blossom in the late spring and often over a large part of the year, is more truly ours than is generally realized. The gorse, or *Ulex europæus*, to give the plant its scientific name, does not thrive in warm countries, and even in southern France it is regarded as a great curiosity. If removed to a colder climate the plant dies, and in Sweden Linnæus found it impossible to cultivate it without the protection of a glasshouse. Even in the north of England the plant does not flourish as it will in the south, whilst in the Highlands of Scotland gorse is a rarity. It is not, indeed, able to stand great extremes of climate, and during the severe winter of 1895 much of it was killed in various parts of England.

Although the gorse is so wonderfully armed with spines, it begins life in a very unprotected state. In the late spring a hunt in the neighbourhood of the bushes will generally reveal some seedling plants. Those that are only a few weeks old are seen to have no spines at all, but each is possessed of

small leaves three times divided. In this respect the seedling gorse resembles most of the other leguminous plants. Examine a few older plants, those which are several inches high for instance, and it is possible to observe the gradual stiffening of the later leaves into protective spines. Without a doubt these sharp spines, so cleverly arranged that it is almost impossible to approach without being pricked, serve the plant in good stead. Since it makes excellent eating for grazing animals, it is only the terrible spines which save the gorse from being seriously attacked. For centuries gipsies have realized that there are few better foodstuffs for their horses and donkeys than gorse shoots which have been well beaten with a stone, and in some places where soil is too poor to produce good grass, it is grown scientifically as a forage crop, sown, and cut while young and tender.

A Gorse spine magnified presents the appearance of a formidable bayonet.

Photos: S. Leonard Bastin.

As the Gorse bush gets older it loses all signs of leaves and is covered merely with an intricate mass of spines.

As the gorse bush gets older it soon loses all signs of leaves and the plant is simply formed of stems covered with an intricate mass of spines. As a rule the bush will not begin to flower until it is about four years old, and at this time it will be three or four feet high. For many years the plant continues to grow, and in very sheltered positions it has been known to reach the height of eighteen feet. There is little doubt that the gorse bush lives to a great age, and seldom is it known to die from natural causes. Even if the upper part of the plant be cut or burned right down, the roots send up strong shoots which grow with great vigour.

The main stem of the gorse has a curiously twisted habit, almost as if it were trying to emulate a twining plant. Were it not for this fact the wood of an old gorse bush would be useful for making small articles, for it is quite hard and has a pretty grain. It is rarely possible, however, owing to the twist, to get a piece of gorse wood of any reasonable size that has not a hole in it.

Like so many leguminous plants the gorse provides homes on its roots for bacteria which are able to assimilate free nitrogen from the air in the soil. Pull up a young gorse plant and the roots will be seen to be plentifully covered with the nodules or swellings which are the homes of the bacteria. Without a doubt the aid of these bacteria enables the gorse to flourish in very poor ground where there is a deficiency of those nitrates on which plants so largely depend for their well-being.

Most botanical works say that the gorse is in flower from February to June, whilst tradition tells us that, like kissing, it is always in season. As a matter of fact, the common gorse (*U. europæus*) can usually be found with blossoms on it for quite nine

Photo: Riley Fortune, F.Z.S.

THE GOLDEN BLAZE OF THE GORSE.

The Common Gorse can generally be found in blossom for quite nine months of the year.

Photo : S. Leonard Bastin

As a seedling the Gorse has leaves divided into three parts like many other leguminous plants.

months of the year. It is generally at its best in late April and early May, and soon after this the plant really does stop flowering until the autumn. In the summer the dwarf furze (*U. nanus*) takes up the tale and keeps us supplied with the golden flowers until the common species comes on again. In August and September this lesser gorse, growing in and out of the heather, paints the moors with a blaze of crimson, purple and gold. It is really a distinct species, although it is often confounded with *Ulex europæus*. All the parts of the dwarf gorse are on a diminutive scale, and the flowers are notable for their spreading wings. Moreover, although the spines of the dwarf gorse are sharp enough, they are not nearly so rigid as those of the common kind.

The extent to which a gorse bush will flower varies a great deal, but in a good season the plant is so thickly covered with blossoms that the spines are completely hidden.

As the flowers fade away there begins the formation of a pod, so typical of the leguminous plants, in which the seeds are produced. The seeds, when ready for dispersal, are scattered in a very forcible manner by the sudden, one might say explosive, opening of the pod. As the case dries it develops a considerable tension, and finally bursts open, throwing the seeds some distance away from the parent plant. On a hot summer day, where gorse bushes abound, it is possible to hear quite a fusillade caused by the ripe pods opening and dispelling their seeds.

For some reason which is not very clear, the gorse is always at its best near to the sea. The strong winds have a stunting effect on the growth of the bush as a whole, but the mass of bloom and the deep butter-yellow of the flower are seen to perfection in such situations. Seen on some high headland in the light of sunset it will give almost the appearance of a flaming mountain, while the rich honey scent of the flower in the noontide of a warm spring day is unrivalled in its sweet lusciousness.

Photo : S. Leonard Bastin.

Gorse roots provide homes for bacteria that can assimilate free nitrogen from the air in the soil. Thus it is able to flourish on very poor land.

Photo: J. D. Kattar.

One of the smartest-looking sea birds is the Oyster Catcher. It looks very trim stepping about the rocks in its black and white plumage and its long pink legs and strong bill.

X.—Sea-Birds

THE longed-for day had come—the long, exciting day in the train, the arrival at the little Welsh station, and the up-and-down drive to the cottage on the cliffs where the summer holiday was to be spent.

And now the children were out on the rocks, where it was all just as they remembered: the wide blue sea with its romping foam, the little bay of golden sand, the rocky cliffs and caves, and the little stream that tumbled down them, bordered with sea-pinks and campion and asphodel.

They had scrambled down the steep watercourse and were looking out to sea, where the gulls circled and called. Suddenly there was a flash on the water, a streak of silver and shadow that came and went—here and there, and then away. At once the gulls swept in from all sides and crowded on to the water.

"Look, look!" cried Topsy. "It's a shoal of mackerel! The gulls are catching them!" And they watched the birds swooping upon the fish, sometimes catching them under water and swallowing them whole, sometimes missing, and rising to circle and swoop again.

"They are not like the gulls that come up over the ploughed land at home," said Popsi, "are they? They seem much bigger than those."

"I expect they are herring gulls," said Topsy. "'Cos they haven't got black heads. But look at that browny one—is that a gull?"

Topsy looked across at the pool where a mottled brownish bird was swimming in the shadows.

"I dunno," said Popsi. "I thought gulls were always white and grey. I wish dear Summer were here to tell us about them!"

Photo: H. Mortimer and Wm. Batten.

The Cormorant had evidently had too big a dinner, for he stood there choking and fluttering his wings, until with a big gulp the fish went down.

"That is just what I was wanting to do!" said a voice on the rocks above. "I was only waiting till you saw me." They looked up, and Summer was there—no longer now in her rose-petalled gown, but robed like the sea in shimmering blue and green and gold.

"Yes, that *is* a herring gull," she continued, looking at the bird that was now rising from the water. "You see, gulls don't grow up in one summer like the little land birds do. It is four or five years before they are full-grown and can wheel about and do for themselves like those shining white ones over there. All that time they have to be careful lest they are pounced on by enemies like the big black-backed gull, who eats up all the little gulls it can find. That is why they wear a soft browny dress, for then they cannot be seen so easily when they are amongst grass or rocks."

At this point Boodles came clattering down from above.

"I've seen a *monstrous* black bird sitting on a rock!" he cried, as he caught sight of the Fairy Summer. "Do please come and tell us about it!"

Away they all went, up the cliff and round to a point of rock that ran far out to sea.

As they came in sight of the point, two dainty black-and-white birds with slim red legs flew away—their outspread wings barred with black and white, making a brilliant show against the dark rock.

"Oh, how pretty!" cried Popsi. "Are they magpies?"

"Magpies don't have red legs!" said Topsy.

Photo: M. Best.

AFTER THE MACKEREL.

A flash of silver on the water, and at once the Gulls swept in from all sides.

"No," said Summer, "they are oyster catchers, but they are sometimes called sea-magpies, or sea-pies. They eat the shell-fish that live on the tide-line. Did you see what great strong beaks they have? They can knock a limpet off the rock, or open a mussel as easily as if they had a hammer."

"But do come and look at my great black bird!" interrupted Boodles. "Let's creep along very quietly."

From rock to rock they crept, until suddenly, just above them, an astonishing bird stood up against the sky. He was black with a shimmer of green, and he stood glaring at them with long neck stretched out and lifted wings.

"Oh, what a funny beast!" cried the two girls.

The bird had evidently had too big a dinner, for he stood there choking and flapping, till at last the fish went down. Then he gave one glance at his visitors, dropped into the sea, and disappeared.

"Oh!" cried Popsi. "I believe he was a goblin!"

"Oh, no," said Summer, "it was just a green cormorant. He is a great fisherman, and eats about fifteen pounds of fish a day. He catches them under water!"

"Oh! what a lot of sea water he must swallow!" said Topsy.

"Probably he does, for he swallows fish after fish, diving again and again. Then, when he can carry no more he comes back to the rock and disgorges them all, and proceeds to eat them comfortably."

The children gazed and gazed at the place where he had disappeared. They never saw him come up again, though they stayed until it was time to go home for dinner, but next morning he was back in his same old place, watching and fishing from the far-off point.

Photo: Stanley Crook.

In the shadow of the rock a young Gull was swimming—it had not yet got its grown-up feathers, but was a soft brown and fawn colour. In that dress it is better able to hide from enemies than it could in the shining white of the parent birds.

WILD CONVOLVULUS.

HONEYSUCKLE.

From Autochromes by A. Webb.

Black Bryony is a twining climber. The tips of its young shoots will, in the course of about two and a half hours, describe a complete circle.

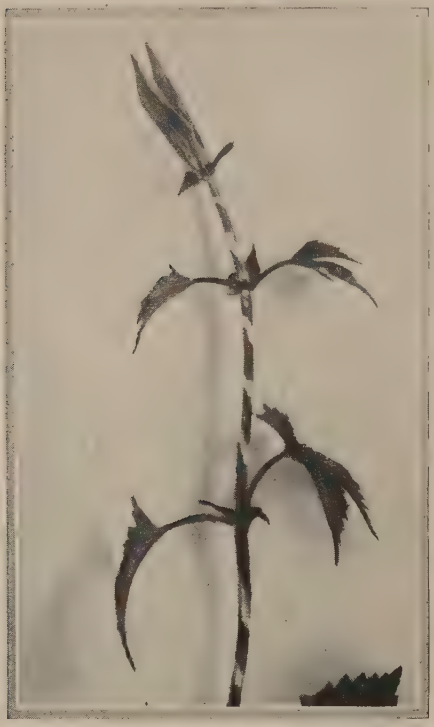
6.—THE STORY OF THE CLIMBING PLANTS

By S. LEONARD BASTIN

With photographs by the Author

IN the modern city where ground space is limited man has been forced to erect lofty buildings in order that he may find room for his activities. Much the same kind of thing takes place in the world of plants where there is an unceasing struggle to secure sufficient light and air for healthy growth. A few species of plants can exist in shady situations, but, generally speaking, green vegetation cannot have too much of the light on which its well-being depends. Plants have adopted various ways of bringing their flowers and foliage to the front, but few have been so successful as the climbing species. By ingenious methods these plants, commonly with weak slender stems, are able to ramble up their stronger neighbours, so that quite often they reach the topmost position, where they can obtain the full benefit of the life-giving sunshine. In another part of this book the story of the tendril climbers has been told, but there are other devices by means of which plants mount upwards.

Probably the most common way of climbing is by means of the twining stem. This habit is not such a departure from the tendency of the average plant as might be supposed. To some extent the stems of nearly all plants rotate during their growth, and this can at times be detected in the case of non-



A line painted perpendicularly on the young shoot of a Hop will in a few days' time become spiral on account of the twisting of the stem.

climbers. Even big trees, such as yews or chestnuts, may show a twist in their trunks. Efforts have been made to explain this tendency, and it has been seriously suggested that it may be due to the rotary movement of the earth. One cannot well accept such a theory, because some plants twist their stems from left to right, like the hands of a clock, whilst others turn in an opposite direction. The most we can say is that a certain plant twines in a particular direction because it has inherited the tendency so to do.

Climbing plants mostly begin their existence in deep shade, the absence of bright light being caused by the vegetation which later on will give support to the climbers. In the tropics most climbing species are inhabitants of forests; in our islands they are found in thickets and hedges. The dense shade in which they start life encourages a long weedy growth, and this helps them to mount quickly, but at the same time makes it essential that they should soon secure some support. When the stem has developed two or three pairs of leaves the spaces between the joints begin to grow unevenly. This causes the stem to curl and revolve, the amount and rapidity of the curve being proportionate to the inequality of the growth. If, for instance, a perpendicular line is marked on the young shoot of a hop it will in a few days assume a spiral formation. Watch the tip of a twining plant and it will be seen slowly and regularly to revolve in circles or ellipses. The movement is known as circumnutation, literally a "nodding around," and it is maintained night and day. The sweeping round of the stems goes on more rapidly when the weather is warm than if the temperature is rather low. On an ordinary summer day the tip of a shoot of black bryony has been observed to describe a complete revolution in about two and a half hours.

With a few exceptions a twining plant will rigidly adhere to its particular method, and no amount of coercion will induce it to grow in an opposite direction. A runner bean which normally twists counter clockwise—that is from right to left—has been tied in order to make it reverse, but nothing would induce the plant to depart from its ingrained habit. It is not quite true to say that there is never any variation in the way in which a plant twines. Darwin mentions an Australian twining plant (*Hibbertia*) which is able to twine both ways just as happens to be most convenient. As this species grows in the scrub it is well adapted for rambling in and out of the bushes. Even a plant so well established in its manner of twining as the runner bean has been known to alter its method. The writer has examined a specimen which followed the same course as the hands of a clock, that is from left to right, but this is exceptional. It has been stated that beans grown in Australia and New Zealand are not so constant to one method of twining as

1. By twining its leaf-stalks round any available support, the Wild Clematis can climb to the tops of quite tall trees. 2. The Great White Convolvulus climbing up a nettle. Twining plants climb best when their support is vertical, and not too smooth.

those which are cultivated in the northern hemisphere, although why this should be so has not been explained. Just a few plants

The Climbing Buckwheat will climb when the weather is warm, but at other seasons it shows little inclination to do so, even when in a shady position.

will twine on some occasions and not on others. The bitter sweet (*Solanum dulcamara*) when growing in an open situation shows no tendency to climb ; if the plant happens to be overshadowed by other vegetation the stems lengthen and finally begin to twist round any available support. The climbing buckwheat (*Polygonum convolvulus*) is a very efficient climber in summer when the weather is warm ; at other seasons of the year it shows little inclination to climb, even if it happen to be in a shady position.

As a rule twining plants are not able to grow round a support unless the latter be nearly vertical ; if the upright is very thick, or has an extremely smooth surface, it may also prove to be unsuitable. Not uncommonly the twining stems of the same plant will twist round one another, a state of affairs which is often seen in the hop and the honeysuckle. When three or four stems are linked together in this way the shoots are able to get upwards to a considerable height without any artificial support. As the twisted stems become older they tend to be more woody and infinitely tougher than the weak, brittle processes which first of all encircled the support. Where, as in the case of the honeysuckle, the stems persist from year to year, serious trouble may arise for the supporting plant. Young and lusty trees are nearly strangled by the embrace of the honeysuckle stems, for once an attachment has been secured they will never relax their hold.

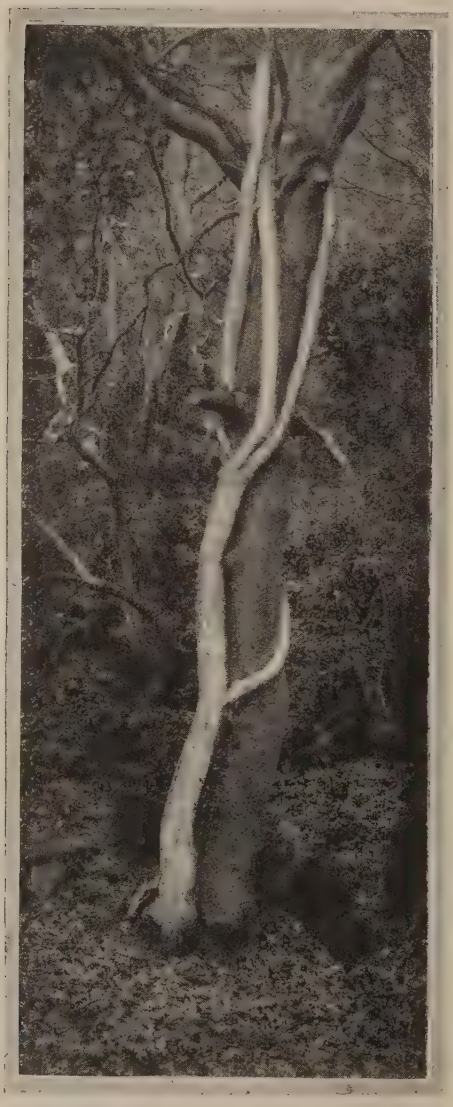
Certain plants which do not climb by twining stems are able to mount with the help of their leaf-stalks. A common instance is the garden nasturtium, which climbs by twining its leaf-stalks round any suitable support. The same method is adopted by that most lovely climbing-plant, the wild clematis, which can climb to the tops of quite tall trees. Even when the bright greenery of summer has gone, the bare and withered stems are able to keep the hold they obtained some months before. The curious part about these climbers is that the leaf-stalks develop on normal lines until they come in contact with some object, when they at once start to coil like tendrils. Put a little stick so that it just touches the stalk of a young nasturtium leaf, and within half an hour there will be a curving towards the support. This will continue until the stalk has completely encircled the stick in such a way that a very strong hold is secured.

The stem of a hop is curiously rough, almost unpleasant to the touch. This harsh-

THE STRANGLEHOLD OF HONEYSUCKLE ON A HAWTHORN.

When, as in this case, the stems of the climber persist from year to year, serious trouble may arise for the supporting plant.

ness is due to numerous recurved hooks which help the plant in its struggles to get up in the world. The hop, of course, has the additional advantage of being a very efficient twining plant.



The Ivy does not kill its supporting tree by sucking the sap, but by its screen of evergreen foliage prevents the free growth of its host.

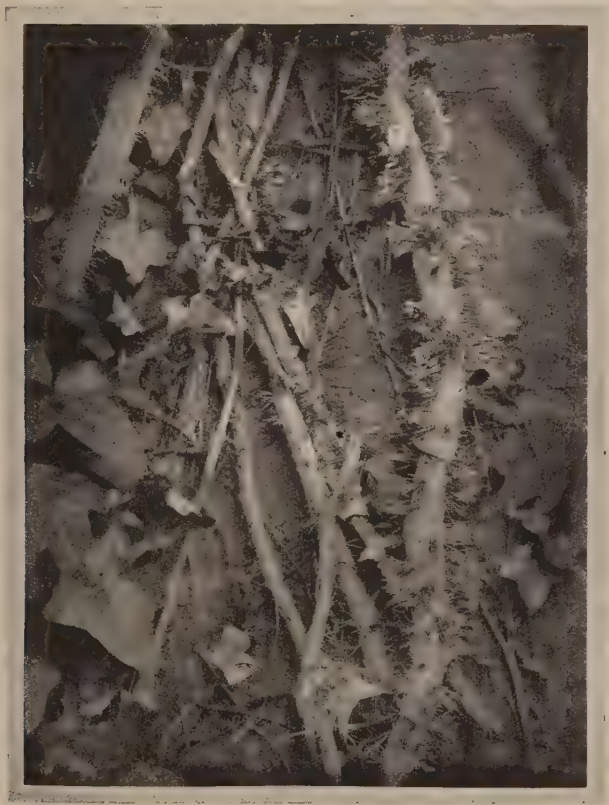
Quite a number of species with weak stems rely solely on prickles and similar processes to help them to scramble upwards. These grappling structures are different from the highly specialized tendril, or the sensitive leaf-stalk, in that they are not responsive to contact, and have no movement of their own. The stems of the bramble and dog rose are provided with large recurved hooks which enable them to catch hold of any support with which they might come in contact. With the aid of these hooks the bramble is able to spread over a wide area, and it will often secure a new root-hold in a most unusual manner. Should the tips of the shoots come in contact with any soil, such as decaying leaf-mould in the crevice of a rock, they rapidly become clubbed and send out roots. This is followed by the production of fresh stems, and as a result a plant which is quite independent of the parent is started. It should not be overlooked, however, that in the case of some roses, notably the burnet-leaved rose (*Rosa spinosissima*), the spines on the stem are straight, and serve only for the purpose of defence.

Probably the most perfectly equipped of our native scrambling plants is the goose grass (*Galium Aparine*). Another common name for this plant, "cleavers," well expresses its power to cleave to anything it touches. Examine the stems and leaves with a pocket lens and it is plain why the goose grass adheres so readily. Stems, leaf-stalks, even the fruits are crowded with hooks which hold tenaciously to anything that comes in contact. No wonder that the goose grass is so luxuriant and is able to overtop the hedge itself, in spite of its weak stems.

Many creeping plants such as the ground ivy (*Nepeta Glechoma*) and the strawberry spread along the ground, sending out roots at intervals from the underside of the stems. From these it is but a step to those plants that make a practice of climbing by means of their roots. A very efficient root climber is the common ivy, a plant which has several interesting points in its life history. The stems grow upwards rather slowly when compared with the rapid extension of a typical twining plant. These are fixed at intervals by rootlets which attach themselves to the bark of tree or the surface of rocks. The stems on which the rootlets

are produced grow away from the light, and this helps to bring them against a support to which they may cling. The avoidance of light on the parts of certain organs of the plant is not at all easy to explain. Light usually exerts a retarding influence on growth, so that the side of a plant which is shaded grows more quickly than the side which is well illuminated, hence the plant bends towards the light. This does not explain the light avoidance of the ivy stems which behave in an opposite manner, showing that the effect of light on the living matter in the plant is not always the same.

Another good illustration of light avoidance is to be seen in the case of the tendrils of the *Ampelopsis Veitchii*. Soon after these are developed they deliberately grow towards the dark places, seeking out cracks and crevices in a most ingenious manner. Obviously, if the tendrils grew towards the light they would stand a very poor chance of securing an attachment.



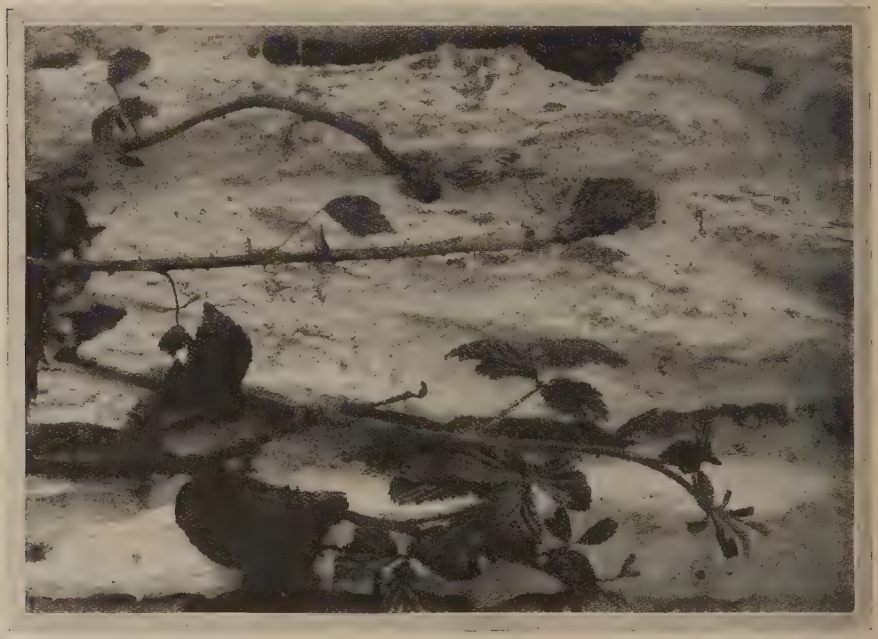
The Ivy climbs by means of rootlets that are produced freely along its stems. So tenacious are they that they will break rather than let go their hold.

Everyone knows how tightly the ivy stems cling, and if pulled away the roots will break at their origin from the stem rather than from the point of attachment. When the rootlet comes into contact with the supporting surface it adapts itself to the smallest irregularities. Often the cells of the processes are drawn out like tubes and

form root-hairs which penetrate into the tiniest cracks. As time goes on the rootlets become dry and withered, yet still they retain their hold almost as tenaciously as they did at the beginning.

On the flower shoots of the ivy no roots are produced ; the stems turn away from the wall or tree-trunk towards the light where the blossoms may be usefully displayed. Exactly what causes the outgrowth of the stem roots is not very clear, for these are often produced abundantly on all sides of the shoot, causing a curiously shaggy appearance. This chiefly occurs when the stem is rather heavily shaded, and it seems likely that the absence of light stimulates the production of more rootlets than can possibly serve as climbing organs. There is little doubt that these superfluous rootlets absorb moisture from the atmosphere, and if, by any chance, they should come into a pocket of soil they will take advantage of the opportunity to absorb such nutriment as may be available. Indeed, the climbing roots are able to serve more than one purpose, so it is little wonder that the ivy is able to hold its own in such varied situations. The common idea that ivy kills trees by sucking away their sap is not correct. Often, however, trees suffer from the stranglehold of the ivy, while the thick evergreen foliage screens the light from the leaves and tends to prevent a healthy development. Small wonder that the forester looks on the ivy as a pest which, if allowed a free growth, will certainly do serious damage to his trees.

Some of the life habits of the ivy suggest that there may come a time when the plant will part company from the soil and appear as a true epiphyte. Every visitor to a tropical forest is amazed at the number of perched plants which depend on rain and the humid atmosphere for their water and mineral matters. In the ivy it has been seen there is often an abundant production of stem roots which, although primarily climbing organs, are capable of absorbing moisture and generally assisting in the maintenance of the plant.



When the tips of Bramble shoots reach any little pocket of soil or leaf-mould they send out roots, and form eventually an independent plant

Photo: George Hearn.

The Wood-mouse is a mischievous, destructive little beast, but he does his mischief with a cheery look, and a sparkle of merriment in his great speaking eyes.

15.—A FASCINATING ROGUE: THE WOOD-MOUSE

By H. W. SHEPHEARD-WALWYN, M.A., F.R.Met.Soc., F.N.B.A., F.Z.S., F.E.S., etc.

IT is all one to the ordinary gardener whether his newly-sown peas are grubbed up by the vulgar vole or the sprightly wood-mouse. The peas go—and a mouse is a mouse. Such is usually the Alpha and the Omega of his knowledge on the subject. Perchance, however, he has had the forethought to immerse the seeds in paraffin or red lead before sowing. Then the peas do not go—though the mouse is still a mouse. Instead, the peas are suffered to reach maturity—which is much kinder to the mice, for it stands to reason that in such a case there is a far more abundant feast for them, and there can surely be no comparison between the wizened, bullet-like little objects which the gardener puts into the ground, and the succulent green morsels which tradition has coupled with our roast lamb and mint sauce. So the lion's share of the peas goes either way—and the mouse is still a mouse.

To the psychologically inclined, however, there is a fundamental difference. Just as a pretty woman will frequently get the benefit of the doubt from the jury-box when her plainer sister might have been convicted, or as the bright-eyed robin is

not grudged a few grains of the chickens' corn when the appearance of a vulgar sparrow will evoke explosions on the part of their guardian, so might one feel less murderously disposed if the culprit caught red-handed be a very model of grace, elegance and refinement, than would be the case with a bull-necked plebeian like the vole. Much is forgiven beauty; it is but human nature. It is not that I should ever profess to hold any brief for the wood-mouse—he is a mischievous, destructive little beast—but he does his mischief and destruction with a bright and cheery look, a sparkle of merriment and vivacity in his great speaking eyes—almost a wink of sly humour when you catch him in the act of nibbling a stolen grain. If much is forgiven beauty, I fancy that even more is forgiven the possessor of a cheery disposition! Surely the man who goes to his death with a jest on the tongue lives longer in the memory than he who merely wears the face of a Greek god. The vole is like the great hulking bully at a public school. When the smaller fry see him coming they skip out of the way. The wood-mouse gets out of the way of the vole like greased lightning. The vole goes about his business of destruction and mischief with a sulky, hang-dog expression on his coarse brown face, the sneaking, sliding gait of the serpent, rather than the fearless sprightly hop, skip and a jump of the wood-mouse. I have in my possession a glass case containing some beautifully set-up specimens of four distinct species of mice captured in this garden, and with consummate tact the artist has disposed one of the dainty wood-mice side by side with an unspeakable brute of a vole. They put one in mind of a gazelle and a pedigree bull—Pavlova and a heavyweight boxer.

Photo: George Hearn.

Like his relative, the dormouse, the provident little Wood-mouse takes the precaution to replenish his store cupboard in anticipation of the more barren months when provisions are scarce.

The wood-mouse—or long-tailed field-mouse as he is frequently known, in contradistinction from the title of short-tailed field-mouse which is sometimes bestowed upon the vole—does not often enter human habitations. More's the pity, for when he does take up his abode in a house for a time, there seems to be an entire absence of that disagreeable and very distinctive effluvium which characterizes the haunts of the house-mouse. At least, that has been my own experience, for there is a hole beneath my front door-step to admit the passage of a telephone tube which incidentally admits the passage of these little visitors into the

bargain. By that means they can find their way direct to the foundations, and there they have the time of their lives—judging from the sounds of scampering and revelry to be heard beneath the floor sometimes in the dead of night. The ordinary mice do not appear to take kindly to these visitations, and, so

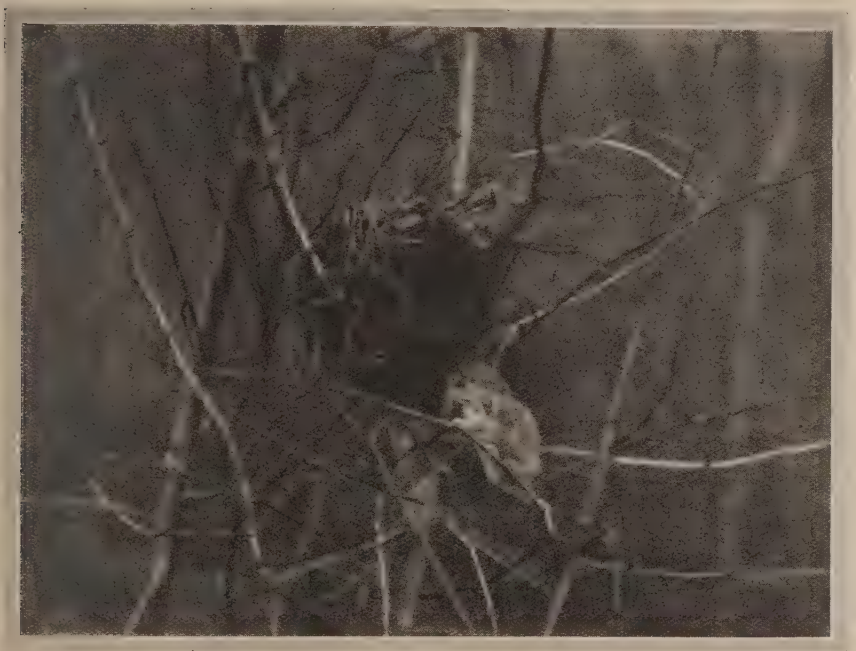


Photo: George Hearn.

The Wood-mouse seldom enters human habitations. He prefers to set up housekeeping among the twigs of a thorn bush, or in the security of some dry burrow.

far as I can make out, unite in giving the intruders a wide berth—which is perhaps just as well for the tenants in possession, since the wood-mouse is a far more powerful animal, and would give short shrift to his little cousin if it ever came to a serious difference of opinion on the subject of rights of way or priority of access to the commissariat department. On the other hand, I doubt whether the advantage of this absence of odour might not be cancelled in some degree by certain characteristics which would render him far from desirable as a co-tenant of any self-respecting domicile.

One morning I came down to discover that fully a square foot of wall-paper had completely disappeared from a corner of the front porch. For some time I was at a loss to determine what agency could have been at work, for the paper was a strong one and in good condition, and a professional paper-hanger would have taken some minutes to strip it off so clean and effectually; but at length my glance lit upon a fragment of pink and green lying near the small hole by which the mice gained entrance—so I knew that these fascinating little rogues must have commandeered the paper by way of material for a nest, and must actually have been presuming to contemplate constructing one in my cellar!

In their natural surroundings the wood-mice generally set up housekeeping in the comparative security of a deep burrow. This is another point of difference from the voles, which are far too indolent by nature to put themselves to such trouble, and always

Photo: Benjamin Hanley.

With his pretty cocked ears and his soulful eyes, the Wood-mouse, or Long-tailed Field-mouse as he is often called, is an extremely decorative little fellow.

tree-trunk. On level ground, however, I have found them employ an ingenious device, similar to the "trap" which is always to be seen beneath a pantry or scullery sink, like an inverted hairpin in shape, driving the burrow down to the depth of a foot or more below the level at which the nest is ultimately placed, with the result that any sudden rush of storm-water is absorbed by the "trap," and the nest and its occupants remain high and dry on the other side.

construct their nests above ground, with no better means of security than that afforded by some thick tuft of grass, and there can be no doubt that their laziness is responsible for a far greater proportion of infant mortality than could be the case with an animal that hides its children at the end of a subterranean burrow. In the choice of a suitable site, the wood-mouse appears to entertain a decided partiality for banks — for the obvious reason that in such a position the danger of being flooded out is reduced to a minimum. At times they will make use of a disused mole-burrow, or even some inaccessible spot in a hollow

As his secondary title implies, one of the chief features of the long-tailed field-mouse is to be found in his tail. Viewed

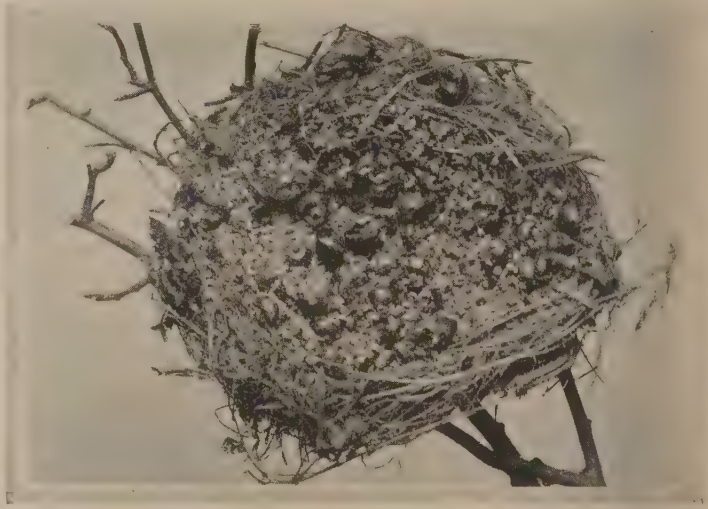


Photo: Henry Irving.

So avaricious is the Wood-mouse when laying up stores that the very size of his larder will often betray its whereabouts. This shows an old bird's nest that he has filled with hips and haws and other seeds.

independently, this is really rather a beautiful object. Four inches or more in length—the same measurement as the entire head and body—supple and sinuous as a serpent, chocolate-brown on the upper side and a delicate cream beneath, it may indeed be considered an appendage to be proud of. The coat itself is of a lively chestnut shade on the back, and quite or almost white on the underside, the line between the two colours being drawn with an almost surprising distinctness.

With his pretty cocked ears and soulful black eyes he looks an extremely decorative little fellow when he sets out a-wooing on a balmy evening. From seven to ten is the usual number of the family, and the wedding bells are heard more than once in the year. Like his relative, the dormouse, this provident little animal takes the precaution to replenish his store-cupboard in anticipation of those barren months of the year when the vitality is low and provisions usually scarce or difficult of acquisition. Unlike the dormouse, however, his eagerness—or should one call it cupidity?—is inclined to overreach his discretion. While the dormouse seems able to judge to a nicety the amount of provender that will tide him over the lean period, and stocks his cupboard accordingly, the wood-mouse appears to pursue the same principle as a very juvenile collector of butterflies or postage-stamps, and enthusiastically gathers everything that he can find. If the dormouse can carry home all he requires in a market-basket, the wood-mouse would require two or three motor-lorries at least to remove his accumulation.

And the sequel? Should a drove of pigs, or other graminivorous creatures, chance to wander through the woods, by reason of its compact and reasonable dimensions the larder of the dormouse will stand a very fair chance of being overlooked by routing snouts or burrowing beaks—but the odds may be reckoned at a hundred to one that next time Mrs. Wood-mouse suggests a visit to the store-cupboard at the other end of the burrow, it will be but to discover that she has unwittingly paid the penalty of her improvident providence.

Photo: Henry Irving.

A Wood-mouse's nest made snug and warm for the winter with a covering of the feathered seeds of the Clematis.

Photo:
H. Mortimer Batten, F.Z.S.

The Mountain Hare, in common with a few other beasts and some birds of high latitudes, acquires a snowy mantle for the winter months.

16.—THE KINDRED OF THE SNOWS: THE ALPINE HARE

By H. MORTIMER BATTEN, F.Z.S.

TO those who have studied the mountain hare it is ever a beast as mysterious and aloof as the mist-swept heights to which it belongs. Long acquaintance with it does not tend to remove this sense of mystery; indeed, the better acquainted one becomes with its ways, the more does one realize that half of them are a closed book, which so far as human understanding is concerned must remain for all times clasped and sealed. Certainly this applies to many other beasts and birds, but the ways of few are so whimsical and incomprehensible as are those of this wraith of the hill-tops.

The white, Alpine, varying, or mountain hare has much in common with the brown hare of our valleys, though in character it stands widely apart; and before passing on to the more interesting features of the mountain hare's life, it would be as well briefly to outline the outstanding features of difference between the two. The mountain hare is the smaller. Of twenty-seven mountain hares weighed one winter in the Loch Tay country the average weight worked out at five pounds and the merest fraction. These were all beasts from the very high country, where the largest hares exist. Mountain hares shot on the lower slopes during the winter are generally the weaklings, driven down by the elements from the high country, and are therefore lighter. The largest moun-

tain hare I ever weighed fell to my gun on Dollar Law, turning the scale at 6½ lbs. and measuring twenty-two inches from the tip of the nose to the root of the tail. Thus it takes a really good mountain hare to be equal to a very mediocre brown hare. It is not such a well-nourished beast, owing, of course, to its hard, harsh mountain foods, and in the Highlands is regarded as fit only for broth. I have purchased numbers at sixpence apiece.

The most noteworthy distinction of the mountain hare is its coat, for, in common with the stoat, the ptarmigan, and a few other beasts and some birds, it acquires a snowy mantle for the winter months. The summer coat is a mixture of "blue," hare-brown, and rabbit grey. The time of year at which the white coat is acquired depends upon the weather and the individual animal, for early in November one may acquire a mixed bag of mountain hares —some in summer coat, some changing, and some completely changed. They begin to alter again in March; and though at one time I was of the opinion that the change was the result of a moult, as with the snowshoe rabbit (a near relative) of Canada, I have since seen so many mountain hares showing every stage of the alternation that this view is subject to revision. It would seem, indeed, that the hair actually changes colour—no pun intended.

The winter coat of the mountain hare is really a very beautiful mantle, but the skin is so thin and tender that the fur, which otherwise would hold a high market value, is practically worthless. I have cured many pelts for the trimmings of children's clothing, but though as handsome as ermine, which it can be made to resemble by utilizing the black ear-tips, it would seem to be impossible satisfactorily to fix the hair.

On many ranges in the Highlands mountain hares exist in veritable thousands. Their runways, leading to and from the more sheltered slopes and from one favoured corrie to the next, cross and criss-cross everywhere in the heather. Entering a corrie I have seen hares passing out the other side in an unbroken string, and I was present at one drive, cut off midway by a blizzard, when three hundred hares fell to a scratch line of six guns. On that occasion, while the light lasted, the animals presented a most astounding spectacle, for they came over the rise till the heather seemed alive with them. Needless to add, the animals were far too thick on the ground, and had proved a great nuisance by diverting the dogs from the proper pathway of duty.

On many ranges, however, that kind of thing is an order of the past, for during the food scarcity period of the war numbers of shepherds found hare shooting more remunerative than shepherding, and, the

Photo: H. Mortimer Batten, F.Z.S.

The Mountain Hare is a tragic beast, whose life is one of hardship, and whose foes are ever at his heels. Yet, game to the end, he manages to thrive and multiply amongst his native hills.

keepers being absent, they made a good thing out of it. The result is that vast areas where mountain hares swarmed before the war are now almost stripped of them. It is, indeed, difficult to believe that so many could have been killed during so comparatively short a period.

Its Mysterious Migrations

Moreover, mountain hares, like black-game and capercailzie, are periodically given to forsaking certain areas where hitherto they have swarmed, and to congregating forthwith about slopes where previously they were few. Thus where two years ago one would see more mountain hares than one could count during a forenoon's ramble, one may find scarcely a hare to-day, and it is thought by keepers that these migrations are the result of the weather conditions of the seasons rather than of food conditions, which generally govern the movements of game. But no man can say with certainty why the white hares come and go ; it is one of the many unanswerable riddles of their lives.

But mysterious as the ways of these beasts are from year to year, they are equally mysterious from day to day. One day we may tread the hill and see countless numbers of them. They rise from every brae we cross, to pause for their customary backward glance sixty feet on, then away again, wild now as the wind. Next day one may cover the same ground and see not a single hare. Indeed, setting out across the hill in the early morning I have found the ground thick with them, but returning by the same way at midday every hare has vanished. One may count on seeing the brown hare day after day at the same places ; he comes by his own private runways, prompt almost to the tick of the clock, and day after day he lives his routine life. But not so the mountain hare. He is as uncertain as the vanishing mists which at all seasons sweep his habitat.

This is a more primitive beast than the brown hare, less associated with man, less ably conversant with man's ways, and, therefore, in common with the Alpine ptarmigan, often regarded as a fool. But the mountain hare is no fool in its own setting. There is a reason for every one of its whimsicalities, but most of these reasons are so profound that wise men cannot fathom them.

Yet, in spite of the foregoing, the individual home range of a mountain hare is, so far as I can judge, much less than that of a brown hare. During a tracking snow I have traced a brown hare down from the heather, following the banks of a burn, a matter of seven and a half miles, into the low country, and back again to the heather, making a detour of over sixteen miles in a single night, and marking her familiarity with feeding grounds over seven miles distant from what I knew to be her home quarters. All the information we have on this point, indeed, would seem to show that the brown hare may be familiar with an area twelve or fourteen miles in extent, according to the abundance or scarcity of food, and within that circle she lives and dies. But the mountain hare is not so great a traveller. If there is a sunny, sheltered corrie at his disposal he may (save for occasional jaunts) never venture more than one mile from a central landmark. Indeed, day after day he may be seen within fifty yards of the same point, and if he leaves that area at all it is as one of a general migration, which takes him to far distant slopes, where soon he establishes a new range.

Its Variety of Moods

More remarkable, even, than this animal's periodical appearances and disappearances are its ever changing moods. One day the hares are tame to the border of stupidity. They are actually to be seen crouching in their forms, and approaching silently it would be possible to get near enough to hare after hare to strike it down. Next day it is impossible to approach within forty yards of one, for they are wild as the wildest March hare which ever fled a stubble field. One day they sit and stare with goggle-eyed stupidity—hare after hare within air-rifle range—but next day, though just as many hares are seen, every one rises and is away like the wind.

This " stupidity " of the mountain hare recalls a sad incident of a few years ago. A serving-maid from one of the hill-holdings had set out to cross the height of land to visit her kin in the next valley, but it was

winter, and she failed to reach her destination. So during the days that followed, the hills were systematically scoured by search parties, and one of these days—a dark, breathless day — the hares seemed to be utterly devoid of fear. Some of the searchers, indeed, killed with their sticks more than they could carry, some while sitting close in their forms, others while trying to hop back through the line of searchers. We found the poor girl at length on a boulder, just as she had sunk to rest ere the snows drifted over her.

Such explanations as we have for these whimsicalities of the white hare are, perhaps, worth offering. In the first place, like the deer, they live with one eye on the weather, and shift their quarters accordingly. Like the deer, moreover, they know when

Photos: Riley Fortune, F.Z.S.

The Mountain Hare in its summer coat of "blue," brown and grey. It is smaller than its lowland relative.

the wind is going to change an hour or so before it actually changes, and proceed forthwith to move their quarters. Thus a pending alteration in the weather conditions may result in a complete shuffling and sorting of the mountain hares, which leave one slope of the mountain almost to a hare and forthwith adjourn to another slope. In this way their movements often predict a change in the weather, and shepherds take heed, but there are other times when no such backing lends purpose to their whimsicalities.

Not so long ago when out on the hill I met with an experience which seemed to clear some of the mysteries regarding this beastie. During the forenoon the hares were unapproachably wild, though the distance was ever alive with them, but towards mid-day I saw an eagle systematically working the corrie quite near to me. Thereafter not a hare was to be seen, and I discovered that they were hiding, singly and in batches, under the lips of the peat hags. Thus every hare had sought shelter more secure than his form, and almost within the twinkling of an eye the corrie, which hitherto had been swarming with the animals, was now apparently "deserted" by them. By dragging down the peat overhangs, indeed, one could have caught numbers of hares by hand.

Why the Hare Looks Back

After the passing of a peregrine, or while buzzards were circling, I have seen a white hare dodging about the rocks, which he would not leave, but like the grouse and the ptarmigan the mountain hares fear the eagle above all living things. Man is among the more modern of their foes; until shot-guns were invented they had little need to fear him, but the eagle is a world-old foe, and for ages past it has stood out as the death's-head of fear. And we need to remember this: that unlike foxes and deer, hares do not possess the gift of passing their knowledge to their young, and so they cannot keep abreast of the times. It takes ages for them to acquire instinctive fear of a certain source of peril. Individuals may learn from sad experience, and grow wise, but dying they take their knowledge with them, and the masses of their race remain in ignorance. Thus, while the deer and the otter and the fox and the badger live abreast of the times, the hares remain as for untold ages past. That is why the mountain hare pauses ever to look back; that is why the brown hare dies, as his father and his father's father died before him, at the snare or the hempen net set across the open gateway. For not one lesson to help them in after-life do the young hares learn from their mother, and solitary from birth, each tiny leveret seeking its own tiny form, so that the cloven hoof which might claim all can claim but one, they remain solitary in knowledge, that is, with nothing to guide them save the heritage of instinct from countless generations of forefathers.

It is generally said that the mating habits of the mountain hare are similar to those of the brown hare, but on this point it is difficult to judge, since the habits of the mountain hare at this period are mainly nocturnal, and to the night belong the mysteries of their courtship.

That mating goes on from February till August there can be no doubt whatever. Leverets so small that the spaniels can catch them are found during the grouse shooting season as late as early September, and during June, July and August I have seen the mountain hares following each other in strings and in a way which clearly intimate mating activities. So, like the brown hare, the mountain hare mates the season through, and in spite of their more bleak environment the season is very little shorter, if any, than that of the brown hare.

Mystery Meetings of the Hares

This brings us to the periodical social assemblings of the mountain hares—the gathering of the clans, call it what you will—for the shepherds of the hills will tell you that on certain nights the white hares meet in thousands at certain appointed places, there to leap in mad ecstasy from bank to bank or from drift to drift, so obsessed that the foxes walk into their midst to slay, to bury and to slay. Why these meetings occur and what conditions decide them it is impossible to say. Mating instincts, possibly, yet they occur at all seasons. Weather conditions? No! It may be clear and moonlight or a blizzard may be in full blast, yet the fantastic meetings take place. And this is the strange part about it—that the night the hares meet in the Grampians they meet also in the Kells; indeed, throughout the length and breadth of the ranges these strange orgies are taking place amidst the cloud-laden heights which will ever hold their secrets.

On the whole the mountain hare always seems to me a tragic beast, whose life is in the bond of hardship, and whose foes are ever at his heels. This is true of the brown hare, but more so of the white. If he himself is not visible we are sure to

find his white jacket, cleanly capsized by Monsieur Reynard, somewhere along the snowy waste, or a raven rises at our feet from the remains of a mountain hare, trampled into the peat hag. During winters of exceptional severity I have known the white hares to come down into the valleys, there to gather about the small holdings, heedless of man and of his dogs, which at such times respect the truce, for the hares are not worth killing.

Had Robert Burns known the mountain hare as he knew so many beasts, and endeared it to the hearts of the Scottish people as he endeared his "wee sleekit, cowerin', tim'rous beastie," it would be better known as the whimsical and pathetically solitary beast that it is, and it would hold a higher place in the regard of the Scottish people. Few creatures have received such scant praise and had less attention bestowed upon them than this denizen of the hill-tops, regarded only as fit for making broth. We find that during recent years field naturalists have cast very little light upon its ways. With one or two exceptions they have been content to quote each other, for not only is the mountain hare a difficult beast to study and to obtain any interesting information regarding, but also its home is too remote from the centres of civilization for many to become acquainted with it.

Yet, game to the end, and ever the common game of all, the mountain hare manages not only to hold on to existence, but if given any chance whatever it will thrive and multiply, and even as an exile from its native hills it can very ably hold its own.

Photo:
H. Mortimer Batten, F.Z.S.

The winter coat of the Mountain Hare is very beautiful, but the skin is so thin and tender that the fur, which otherwise would have a high market value, is practically worthless.

A peculiarity of the Lace-wing Flies is their habit of depositing eggs, not directly upon the leaf, but at the end of a long stalk. The *Chrysopa flava* lays them in bunches, the stalks of each bunch being more or less coherent. (× 4.)

21.—AN ENEMY OF THE APHIS: THE LACE-WING FLY

By K. G. BLAIR, B.Sc., F.E.S.

With photographs by Hugh Main, B.Sc., F.E.S.

THE lace-wing fly is an insect that deserves to be widely recognized as the friend of man, for, like the hover fly and the ladybird, it is an inveterate foe of the aphides or greenfly tribe, the most destructive insect pests with which horticulture and agriculture in this country have to contend.

It is an insect of moderate size but slender build, the delicate body of a bright green colour, frequently with a yellow stripe down the back, and sometimes more or less marked with black—for it must be borne in mind that under the one popular name lace-wing fly, we have in this country about a dozen distinct species differing from one another in minute points of structure, in colour, and to a considerable extent in their habits. The fly is furnished with two pairs of ample wings from the delicate net or lace-like structure of which is derived its name. These wings consist of a clear transparent membrane supported by a system of nervures running longitudinally from the base, and occasionally emitting branches which run obliquely to them, these being connected by a few short cross veins, thus producing the net-like mesh. In most of the species these nervures are all green (though in some they are more or less marked with black), thus imparting a tint of green to the wings as well as the body; further, the wing-membrane itself in certain lights exhibits beautiful purple and iridescent reflections, more pronounced in some of the species than in others.

The beauties of the lace-wing fly, however, do not end here, for one of its most striking features when examined at close quarters is contributed by the large, round, brilliantly golden eyes, whence is derived its scientific

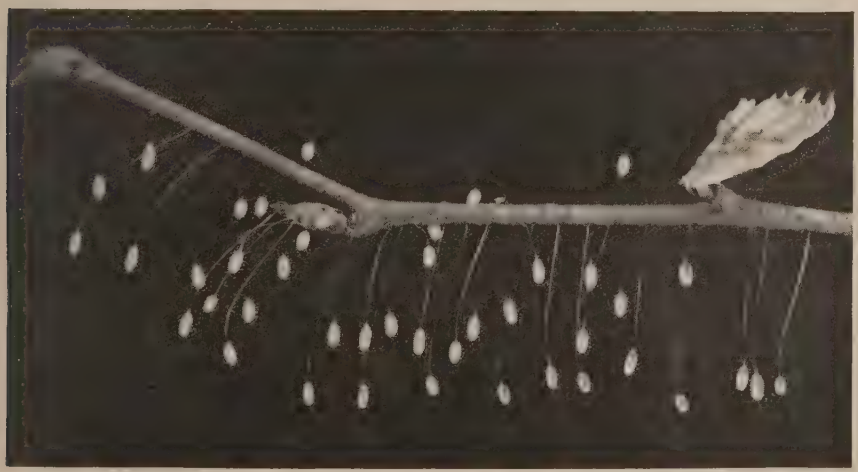
name of *Chrysopa*, or golden-eye. Nor, in the face of so much beauty of structure added to its, to us, beneficial habit of devouring plant-lice, should one cavil at its possession of a feature that is not so pleasing, viz. a rather strong and to some people disagreeable odour. The delicate colours, unfortunately, are not stable, but disappear soon after the death of the insect, the beautiful green of the body fading to a dirty yellow, or even, owing to the decomposition of the contents of the alimentary canal, becoming black, and the brilliant golden colour of the eyes giving place to dull black or grey.

The egg of the Lace-wing Fly, *Chrysopa tenella*, is a short stalk egg laid singly. (× 5.)

The lace-wing flies are essentially summer insects, being found from May till September. One autumn species is known to survive the winter in the perfect state, and it is rather curious that in doing so it frequently changes colour, for many of the hibernated specimens found in the spring are of a pinkish hue.

They are mainly crepuscular in their habits, resting among the foliage during the day, from which, however, they are readily disturbed. They take to the wing about dusk, and their flight is slow and feeble. The different species are not all found in the same situations; some of them show a distinct partiality for gardens, and are, therefore, most plentiful in suburban districts. Others prefer the woods, some those with moderately dense undergrowth, while others frequent places of a more open nature, and are particularly fond of the young growth that springs up when a wood has been recently felled. In such a situation they may sometimes be found in immense numbers, several dozens being disturbed from each clump of young birch or oak scrub. Usually, however, they occur very much more sparingly.

One noteworthy peculiarity of the lace-wing flies is the habit of depositing their eggs not directly upon the leaf or twig, but supported from it at the end of a long stalk. This gives them a certain resemblance to the stalked capsules of many of the mosses, amongst which, indeed, they



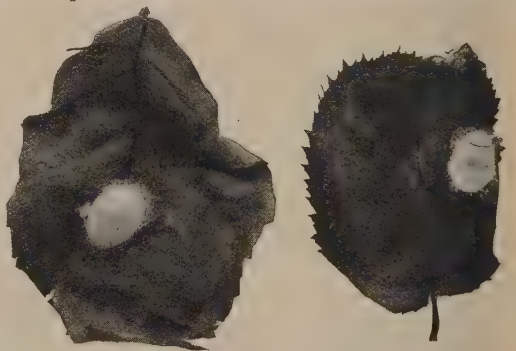
Owing to their curiously long stalks the eggs of the Lace-wing Fly were placed by earlier naturalists among the mosses. These are from *Chrysopa septempunctata*, laid in a group along a twig. (× 4.)

were placed by some of the older naturalists. In this habit many of the species show very marked characteristics. Thus one of them deposits its eggs singly on the edge of the leaf, or on the edge of a hole in the leaf, on a comparatively short stalk, and always in the plane of the leaf; another will deposit them singly, but on a long stalk vertical to the plane of the leaf; another similarly, but in groups of a dozen or more, in fairly close proximity, while *Chrysopa flava*, the one that forms the subject of the photographs illustrating this article, places them close together, so that the stalks of the different eggs of a group all adhere compactly, the eggs themselves all bunching out at the top of the column of stalks. The formation of this stalk is interesting; the female applies the tip of her abdomen to the surface of the leaf, at the same time excreting a drop of clear fluid which very quickly hardens on exposure to air. As this flows out she raises her abdomen, and thus draws the cement into a thread that hardens as it forms. At the top of this she leaves her egg.

The larva of the Lace-wing Fly (*Chrysopa flava*) is short and stumpy, tapering behind to a tail, which it uses as a terminal prop. (× 2.)

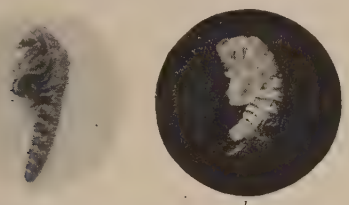
The egg when first laid is pale green, but as the larva develops within it becomes pearly grey, and the eyespots, and frequently the segmental divisions, can be perceived through the shell. In about a week the young larva is ready to hatch; for this purpose it is provided with a kind of saw on the front of the head, and by moving this up and down it cuts a slit in the egg-shell through which it can push its way into the world. In doing this it undergoes its first moult, leaving its first skin, with the egg-breaker attached, inside the vacated egg-shell. At once, then, we note two points in which the hatching of the lace-wing fly larva differs from that of the butterfly caterpillar, viz. the occurrence of a moult accompanying hatching, and the presence of a definite organ, which is shed during the operation, for breaking the enclosing egg-shell. The necessity for the latter we shall understand better after considering the peculiar nature of the jaws of the larva; whereas the moult may perhaps be considered as a means of discarding this structure for which there will be no further use, although a similar moult occurs in other rather primitive groups of insects in which no special egg-breaker has been demonstrated (e.g. the field-cricket).

After hatching the young larva frequently remains perched on his empty egg-shell for some hours before climbing down the stalk and wandering off in search of aphides, and even then he will frequently climb up the stalk of an adjacent egg and make a meal of the contents, if still unhatched. In view of this pleasant little habit it is not easy to see wherein lies the advantage to *C. flava* of bunching its eggs together, since frequently more than half of a brood is thus destroyed by the more precocious members. Indeed, even much later in life the lace-wing fly larva has little brotherly regard for his fellows, for he will seize and suck another almost as readily as he will an aphid.



Cocoons of the Lace-wing Fly (*Chrysopa flava*) before and after the pupa has emerged. The secretion from which these are spun is derived from the tail-end of the insect. The illustration on the right shows the line of opening. (× 2.)

The method of feeding and the structure of the jaws are worthy of notice. These are seen to be a pair of sharp sickle-shaped structures projecting in front of the head

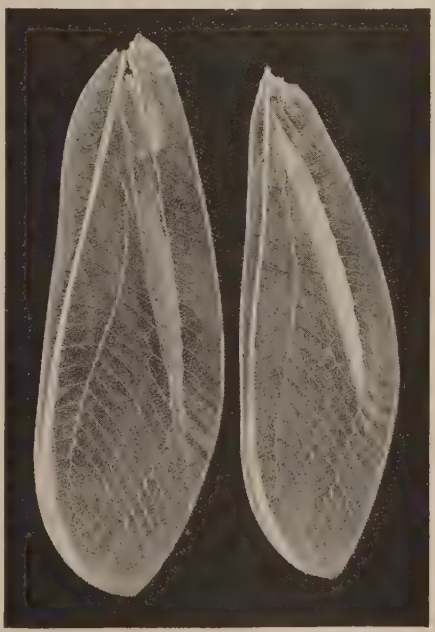


(*a*) The pupa of the Lace-wing Fly (*Chrysopa flava*) ready for emergence. (*b*) The pupa just out of the larval skin. (× 3.)

and about as long as the head. They are not adapted for biting off and swallowing portions of the food as are the jaws of a caterpillar, but merely for seizing and holding their prey like a pair of callipers. By themselves they are useless for feeding, and for this purpose the maxillæ, or second pair of jaws beneath them, are brought into play, that on each side being closely applied to the underside of the jaw, which it fits so as to leave a hollow channel between the two. Up this channel the juices of the prey are sucked into the mouth. We now see how it is that the young larva requires a special instrument in order to effect its exit from the egg, since its jaws are of a type totally unsuited to nibbling a way out as do the jaws of the young butterfly caterpillar.

The young larva is a short, stumpy little creature with three pairs of fairly long legs. It tapers behind to a narrow tail, which it uses as an additional leg or terminal prop. On the back are a number of rather long hairs not very closely placed, which serve to hold in place the bits of dirt and old aphis skins which most of the larvæ like to pile on to their backs. As they grow older the larvæ of some of them, amongst which is *C. flava*, lose this habit and also the long hairs, but in many of the species the habit becomes accentuated, and prominent tubercles, each bearing a tuft of hairs, are developed along the sides and down the back. These retain a dense mat of old skins and other rubbish, often felted together by the waxy secretions of certain aphids, which entirely conceals the body of the lace-wing fly larva. This habit is no doubt protective in function, for the larva is completely disguised and looks like a little bit of dried dirt, and even when it begins to move its real identity is disclosed only to the initiated. Its gait is oddly suggestive of a "tank"; the squat body low down to the ground and heavily armoured above, the sharp projecting jaws turning from side to side as it progresses, and the rear end, alternately humped up and extended as the terminal prop is brought into play, all combine to give it a heavy and threatening aspect as it moves along in search of prey; this effect is less marked in the naked and more elongate larva of *C. flava* than in most others.

When food is plentiful the larvæ grow quickly, attaining their full size in about three weeks, in the course of which they have undergone two moults. When full grown they wander off in search of a convenient place in which to complete their



The delicate wings of the Lace-wing Fly (*Chrysopa flava*) from which it derives its name. In certain lights they exhibit beautiful purple and iridescent reflections. (× 4.)

metamorphosis, and the full-grown larva may frequently be seen wandering over wooden fences or even brick walls in search of some suitable crevice. Here the larva proceeds to spin a cocoon in which pupation will take place; but unlike the caterpillar of a butterfly or moth, which make use of silk derived from the salivary glands and spin from the mouth, the lace-wing fly larva spins with its tail-end, using a secretion derived from the Malpighian tubes. Probably it is due to the greater mobility of the tail as a spinning organ that the cocoon of the lace-wing fly is smaller and fits more closely to the doubled-up body of the contained larva than do the generality of moth cocoons. It is also more compact, of almost a parchment-like texture, nearly spherical in shape and white in colour, surrounded with a few loose threads of silk.

Within its cocoon the larva lies tightly packed, its head and tail doubled beneath it, until the spring, when pupation takes place. The pupa is white, with the limbs free, not glued down to the body like those of a butterfly or moth chrysalis, and is provided with a strong pair of horny jaws very different from those of the larva. It is only when development is far advanced and the emergence of the perfect fly is almost due that these jaws and also the legs become functional, for though free, the muscles to operate them have not heretofore been sufficiently developed. But when all is ready the jaws are used to cut off a circular lid from the cocoon and the pupa makes its way out and climbs up some stem or other support before the final moult takes place and the fly emerges. Frequently the empty pupa skins may be counted by the dozen on some of our suburban fences, some only a few inches from the ground, but others a few feet up, and some of the flies themselves with freshly expanded wings will be found close by. That a fly of such a size could have emerged from the shrunken remains of the cast pupal skin is at first almost unbelievable, and the credibility of the fact is not increased if the empty cocoon within which the whole has been packed away all the winter be discovered.

The Lace-wing Fly (*Chrysopa flava*): the perfect insect at rest. (× 2.)

Before taking flight the fly drops a dark-coloured pellet, a fact which draws attention to another interesting point in its economy. Owing to the fluid nature of the food taken in by the larva there is very little solid waste from the process of digestion, and none is passed by the larva. Indeed, the gut does not form a complete tube throughout, but the middle portion of it is solid, so that all food swallowed stops at the stomach, and any undigested remains are stored up there until after the emergence of the fly, when they are ejected in the form of the pellet above mentioned. The posterior end of the larval intestine is again open, but only to receive the secretions of the Malpighian tubes, and deliver them as a silk-forming cement.

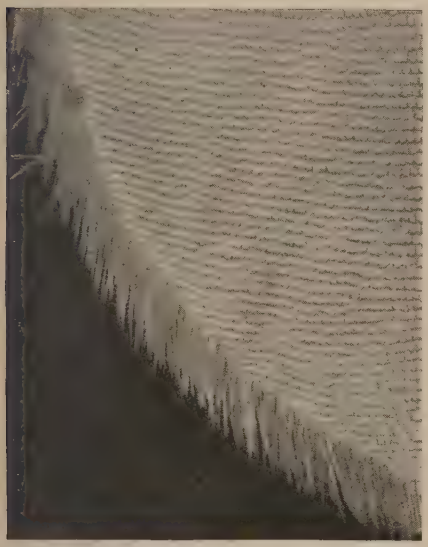
To the scientist perhaps the chief interest of the lace-wing flies lies in their position as representatives of a comparatively primitive order of insects. Not only is the wing venation and the construction of the body of a relatively simple type, but other points in their life history, *inter alia*, the possession of an "eggbreaker" in the hatching larva, the functional jaws and limbs of the pupa, etc., all point to the order having arisen as an early branch in the great group of insects that possess a complete metamorphosis, i.e., a grub-like caterpillar or larval state followed by a resting pupal state—a group which comprises the butterflies, beetles, bees, and two-winged flies, as distinct from those such as the crickets and grasshoppers, the dragon flies, etc., with an incomplete metamorphosis in which the young are very similar in form to their parents.

22.—PERFUMED BUTTERFLIES

By A. HAROLD BASTIN

With photographs by the Author

IN the year 1876 the late Fritz Müller —a German by birth, and certainly a great and painstaking naturalist—called attention to certain "perfumed" male



The colours and patterns of Butterflies' wings are due to innumerable minute "scales," arranged row after row like tiles on the roof of a house.

butterflies of Brazil, in which country many years of his life were spent. Since this date similar curiosities have been discovered in most parts of the world, where butterflies occur, including Great Britain, where our green-veined white (*Pieris napi*) is a noteworthy example.

How do these butterfly perfumes originate, and what is their significance or "use"? The reply to the first part of this question is that the odours have been definitely traced in many instances to certain of the minute "scales" which clothe the insects' wings. So far as we know, the vast majority of these scales serve no other purpose than that of piecing together the colour mosaic of the wing-pattern; they are, as it were, the tiny touches of pigment by means of which Nature gives to each species its characteristic adornment. But if we examine a portion of the wing surface beneath the microscope, we often find that a few of the scales differ from those by which they are surrounded in being attached by their stalks to peculiar glandular cells.

These specialized scales are the scent-scales, or "androconia," as they are called by men of science. The glandular cells from which they arise secrete a volatile fluid that passes into the scale, and is eventually given off from its surface as an odorous vapour. The androconia differ considerably in shape in different species of butterflies; but they usually agree in being branched, or tufted, at their free extremities—an arrangement which apparently facilitates the rapid diffusion of the perfume upon the air. As we have seen, they are frequently scattered among, and

A portion of a Butterfly's wing highly magnified. The "scales" are in reality just modified hairs.

A male Silver-washed Fritillary. The "androconia," or scent scales, occur mainly along the three dark lines of the fore-wing.

often hidden by, the ordinary scales; but they are sometimes massed together in brand-like patches, or along certain prominent "veins" of the wing. In other instances they are concealed beneath a fold of the wing membrane, or within a little pocket or pouch.

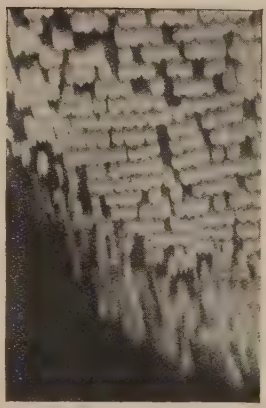
Other butterflies have manes of long, scent-distilling hairs on a restricted area of each hind-wing; while tufts of somewhat similar hairs are found on the legs of certain moths, such as the male of our ghost-swift moth (*Hepialus humuli*). Since an insect's scales are really modified hairs, we are entitled to regard these tufts as strictly homologous with groups of androconia, such as those which have just been described.

The odours given off by insects are not always perceptible by man. On the contrary, we often fail completely to detect them. But we have strong presumptive evidence that an insect's sense of smell may be far keener than our own. We know, for example, that the males of certain moths fly from wellnigh incredible distances to their mates, being guided, apparently, by a distinctive "feminine odour" peculiar to the species—an odour rare and delicate beyond anything that we can imagine, yet sufficiently penetrating and seductive to guide the sex-hungry male along the proverbial "bee line" (it may extend through *several miles* of space!) to the spot where his consort waits. We need not, however, rely in this matter solely upon deductive reasoning, for in certain instances the evidence of direct experiment is available. Let the reader capture a male green-veined white butterfly—distinguished from the female by the less heavily drawn dark veins on the white surface of the wings, and by the presence of only *one* black spot (there are *two* in the female) on the disk of each fore-wing. Then, holding the captive gently by the folded wings between the finger and thumb, bring it close to the nose, and inhale slightly. A fragrance, which has been likened to that of the well-known "lemon verbena" plant, will be apparent. To conclude the experiment, it is necessary to brush from the butterfly's wings some of the dust-like scales, and transfer them to a glass slip for microscopic examination. Under a fairly high power, the androconia (which in this instance are very remarkable in shape) may easily be made out—mixed

A female Silver-washed Fritillary newly emerged from the chrysalis.

up, of course, with large numbers of the ordinary wing-scales. Similarly shaped androconia may be found on the wings of the "large" and "small" cabbage white butterflies (*P. brassicæ* and *P. rapæ*).

Another British butterfly whose androconia are worth looking for is the male silver-washed fritillary (*Argynnis paphia*). They will be found to occur mainly along the three thickened black lines, each about half an inch in length, which traverse the central area of the fore-wing. Whether the odour which is certainly exhaled by this butterfly can be detected by man is a point upon which authorities are not agreed. Among other *Nymphalidæ* butterflies, the male meadow brown (*Hipparchia janira*) has the same elongate type of scent scales.



Magnified portion of a wing of the Green-veined White Butterfly. The scent scales are hidden.

We now come to the second part of our question, What purpose do the odours given off by insects serve? To begin with, we have very good reason to believe that odoriferous insects may be classed under two headings—i.e. some smell "nasty," others "nice." This does not mean that we men and women, by a direct appeal to our olfactory sense, are capable of referring a given insect to its proper group, because the odours given off by certain "nasty" insects may seem to us rather "nice," or *vice versa*. What is meant is that the odours of insects are "nasty" or "nice" in relation to the apperception of their own kind, or of those creatures with which they come into direct touch in "the struggle for existence."

So far as "nasty" or repellent odours are concerned, there seems small room to doubt that they act, in conjunction with

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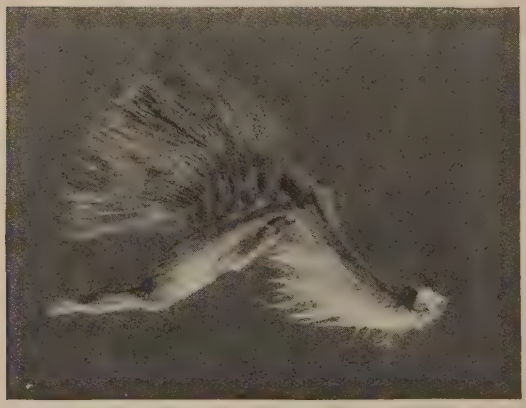
1. Highly magnified scent scale from fore-wing of the Silver-washed Fritillary. 2. Scent scale from wing of a Green-veined White. The odour distilled by the latter scales has been likened to that of the lemon verbena plant.

peculiar and arresting colour schemes, as a life-saving device of very widespread importance. This is the theory of "warning coloration," to which reference is made elsewhere in these pages. But there is nothing in this theory to account for those odours which are exhaled by the individuals of one sex only. These we may refer with considerable confidence to the "nice" group. That the androconia-bearing, perfume-emitting male butterflies are irresistibly attractive to the females of their kind has been proved, in many instances, beyond all possibility of quibble.

The male and female of the Ghost Swift Moth. The female is the larger of the two.



The tuft of pineapple scented hairs that are found on the hind-leg of the male Ghost Swift Moth. (*Greatly enlarged.*)

This is true also of the *Hepialid* moth previously mentioned, whose hind-legs carry tufts of scent-hairs that emit a strong perfume not unlike that of pineapple. As is well known, this insect has shining white wings, which make it very conspicuous when, as is its custom, it comes abroad to dance in the twilight above the herbage among which the inconspicuously coloured females lie hidden. When one of the latter chances to perceive the pineapple perfume, she flies from her hiding-place, and mating takes place. On the other hand, when delicate odours are exhaled by the female, but not by the male, we find that it is the latter sex which flies to the former—sometimes, as we have seen, traversing great distances.

Thus, it seems reasonable to argue that these androconia are a definite part of the butterfly's love-making paraphernalia. Darwin realized the importance of what we now call "sexual selection," and referred to it as "a second agency . . . tending to produce the same effect" as natural selection. It is, of course, necessary (as Sir Ray Lankester has pointed out) to distinguish carefully between the "extraneous" self-consciously devised courtship allurements used by mankind, both in primitive and civilized societies, and those which are "intrinsic" to the animal body. The functionings of the latter are purely organic; nor can we doubt that their apperception belongs to a different order of mind from that which governs the intellectually controlled behaviour of man. Nevertheless, we can hardly deny that *all* courtship activities, whether they arise "unconsciously," as in the lower animals, or are practised with "conscious deliberation," as in man, are one alike in origin and in aim.

When wings are outstretched in flight, it will be seen that they are cambered, i.e. curved at the shoulder and towards the tip from the leading edge to the trailing edge.

40.—THE MECHANICS OF BIRD FLIGHT

By CLARENCE WINCHESTER

THERE are few who now believe that flying creatures traverse the air through the exercise of any unknown forces or by making use of any principle not in accordance with the laws of mechanics and physics. All the creatures which make use of the air as a supporting medium, whether for long distances as in the case of birds, or short distances as in the case of flying fish, use the muscles of their body, the resistance of the air, gravity, and the form and movements of their "planes" and body. Since man himself, after centuries of struggle, has at last succeeded in flying, the mechanical principles of flight have been better understood, and it has become more possible to interpret the flight of animals by mechanical principles.

Whether we take the flight of birds, or insects, or certain fishes, the same principle of attack is applied, only it seems at first glance that certain creatures use more efficient methods. On closer examination it will be found that the methods vary according to the functions which the particular creatures are called upon by nature to perform, these functions being regulated by curious circumstances, and the efficiency of the wing surfaces being regulated by the functions. For example, the albatross—a long-distance bird—has a peculiarly efficient wing design which includes a large span (i.e. measurement from wing-tip to wing-tip). The wing surface of the butterfly is relatively inefficient (except, of course, in so far as it succeeds in enabling the butterfly to do what is expected of it). The plane surfaces appear excessive in proportion to the body, and this fact is more strikingly obvious if a comparison is made between the butterfly and, say, the bee.

The flight path of the butterfly is staggering and erratic, and there is a reason for this. The irregular flight path aids the butterfly in dodging its enemies. If a chart were made showing the butterfly's course variations in all directions, laterally, longitudinally and vertically, the result would be little short of bewildering. And it is this result in actual flight that so often saves the butterfly from its pursuers.

Reference has already been made to the apparently excessive area of the butterfly's wings. In most flying creatures it will be found that the area of the plane surfaces is something over that actually required to lift and propel the body through the air. The excess is a margin of safety which allows for emergencies. Sometimes it happens that the butterfly is unfortunate and is wholly consumed by an enemy, but there are occasions when the pursuer succeeds in nipping out only a part of its victim's wings. The advantages of the margin of safety are here obvious. The victim is not brought to the ground, for there remains sufficient area for support and propulsion. Man has adopted similar safeguards. His flying machines have a margin of safety to enable him to withstand sudden and unexpected stress in moments of emergency. It is when this additional stress exceeds the margin of safety that disaster occurs.

Now, before going further into the mechanics of flight it is necessary to have some idea of the qualities of the medium through which flying bodies pass and in which they are immersed. Comparisons are frequently made between water and air; but it is doubtful if these comparisons serve any very useful purpose, except in presenting to the mind a clearer conception of the formation of the air, and the effect of moving bodies upon it.

A fish passing through water meets with resistance which it overcomes, because the water is less solid than the fish. The layers of water are disturbed by the fish, and flow round it, causing eddies, the nature of which depends upon the speed and the body design of the fish. Similar circumstances surround a bird in the air, only with this important difference: air is about seven hundred and seventy times less dense than water, and is more elastic. So it will be seen that comparisons, if not odious, are helpful only in the one direction already stated, and if they are made in this article it is because the density of water provides a basis for the explanation of certain principles.

Photo: Capt. H. Morrey Salmon, M.C.

The black and white wings of the Oyster-catcher are very striking when outspread in flight.

Although air is so elastic it provides a recoil, as does water. The force of the recoil of water may be tested by bringing down the hand sharply upon the surface of the water. The resistance is considerable. In the air the resistance is less, but it is there all the same. That is why the propulsive surfaces of the fish (tail) and the bird (wings) show such a marked difference in size. In both creatures the bodies have some kind of stream-line form in order to lessen the resistance as they pass through water or air, as the case may be. The best stream-line form is one which reduces the resistance to a minimum. High-speed flying creatures and machines have the fewest flat surfaces facing the direction of flight.

Photo: Capt. H. Morrey Salmon, M.C.

In cases of birds that are good flyers, such as the Gull, the area of the "lifting" or wing surface is greater than that of the "non-lifting" surfaces.

Photo : G. C. S. Ingram, M.B.O.U.

A Lesser Tern in flight well illustrates the fact that bodies of birds have some kind of "stream-line" form which lessens the resistance of the air.

This does not necessarily mean that by paring down opposing surfaces the flying bodies must be made exceptionally light, for strange as it may seem, it is possible to have too little as well as too much weight in relation to flight. If any flying creature be weighed it will be found that nine times out of ten it is as heavy proportionately as any land creature.

Weight and strength are as important to the bird as are efficient wing surfaces, for without the requisite weight the bird would simply flounder and would be at the mercy of the wind, as it would be impossible for it to make use of its weight in the form of stored-up energy. It would be like a cork on a rough sea, except that instead of floating on its supporting medium it would be immersed in it.

Man has realized that flying machines need to be of moderate weight as a help to stability, and both in birds and flying machines the weight must be scientifically distributed. A bird that was tail-heavy would have considerable difficulty in alighting; and if there were too much weight at its extreme fore-part it would be unable to rise into the air, assuming, of course, that it had wings of normal construction and power.

The air, in relation to a bird, may be likened to an enemy which it is necessary to attack and subdue, and finally to harness. Unless the flying creature, bird or man, succeeds in attacking and successfully controlling the air, the air itself will remain master. Until recent years it had remained the master of man, and he is still fighting for complete victory over this lightest of the ordinary media; but the birds and other natural flying creatures, through evolution, are better equipped for the contest. The outcome is that their natural flight is a complete victory over the air.

A bird has two kinds of surfaces—lifting and non-lifting. The area of the latter is less than that of the former in instances where the bird is a good flyer, but there is a balance struck between them according to

Photo: Niall Rankin, F.Z.S.

The air, in relation to a bird, may be likened to an enemy, which it is necessary to attack and subdue, and finally to harness. In this battle the Gulls may be considered some of the most successful of all birds.

Photo: G. C. S. Ingram, M.B.O.U.

GUILLEMOT FLYING UP FROM THE SEA.

The up-stroke of the wing creates an "up-draught," part of which is met with on the return stroke. The wings must therefore vibrate at high speed, or the resistance would be lost and the bird sink to earth.

Photo: Capt. H. Morrey Salmon, M.C.

In gusty weather the feathers towards the wing-tip and at the rear are spread open, and manipulated so as to "spill" the wind that is not wanted.

the conditions which the bird is calculated to experience. It would require a volume to detail these differences and another to deal with bird life in general, but a simple illustration of one marked difference in this connexion is that between the albatross and the town sparrow.

The albatross has proportionately large lifting surfaces, though it must be pointed out that the sparrow (and other quick-flapping birds) increases its wing efficiency by rapid beats upon the air. The gull, when its speed is reduced—for example, when it is catching food thrown into the air—will rear its head and lower its tail to bring about a braking effect, at the same time giving rapid beats with its wings to provide support and counteract the force of gravity. Wings, therefore, are most efficient when travelling at speed or when being beaten rapidly. The importance of weight in relation to speed will here clearly be seen. Further, even non-lifting surfaces derive some support from the air when they are moving at high speed.

The construction of the bird wing has an important bearing upon flight, and to simplify explanations we will take any large bird and imagine it gliding through the air with its wings outstretched. For the moment we will ignore the flapping process. It will be noticed that the wings are cambered, i.e. they are curved at the shoulder and towards the tip from the leading or front edge to the trailing or rear edge. Excusably it might be thought that most of the "lift" is obtained from beneath that arch, but actually the underside of the curve, or camber, does not provide the greater bulk of the lift.

During gliding flight the bird does take advantage of rising currents, but by using its own momentum and changing the curvature of its wing surfaces, it can also ascend for short distances through still air, or take temporary advantage of adverse currents—"tacking" as it were, in three dimensions. But if there is no balance of upper current, it must inevitably slowly descend, unless it uses the energy of its own muscular action.

Imagine, now, that the flying creature is met by strong gusts. If there were no

way to lessen the force of these gusts, the bird would suffer undue fatigue and loss of power—a contingency in flight to be avoided. The bird, however, is able to reduce the effect of gusts by resorting to the familiar practice of "wind spilling." The feathers towards the wing-tip and at the rear are spread open and manipulated in such a way as to spill the wind which is not wanted—a plan which has not yet been adopted by man to its fullest possibilities.

The wing-flapping method of flight has so far been unattainable by man because of the difficulties in reproducing and operating bird-wing structure. It is not so much the building as the manipulation of such a structure which presents a problem difficult of solution, and it is far from certain that flapping flight would be so efficient an application of engine-power as the use of a rotatory screw-propeller.

Professor J. Bell Pettigrew, the physiologist, has shown that all natural wings, without exception, act as screws, in that they twist in opposite directions during the down and upward strokes. On the upstroke as well as on the downstroke during horizontal flight the wing always strikes, or moves, forwards, and at the same time the main structure of the wing twists and untwists, thus forming a variable screw. The upward and downward strokes are inter-dependent, for when the wing is drawn rapidly upwards and forwards it creates an updraught, part of which is met with on the return stroke. In this way more support is gained on the downstroke because it meets with more upward resistance. The upward and downward strokes merge into one another, and the wing consequently makes certain currents itself, which it uses advantageously.

The recoil or resistance will vary according to the elasticity of the air and the design, surface and speed of the wing beating upon it, and as the wings vibrate they are shot forward—this being the result of their peculiar design. It is this beating movement which distinguishes natural from artificial flight, the artificial machine having rigid or, at the most, semi-flexible planes, and being pulled through the air by a powerful engine. The natural flyer uses the energy of its muscles exactly as is done by a running or walking animal, but applies it to the moving of the wings.

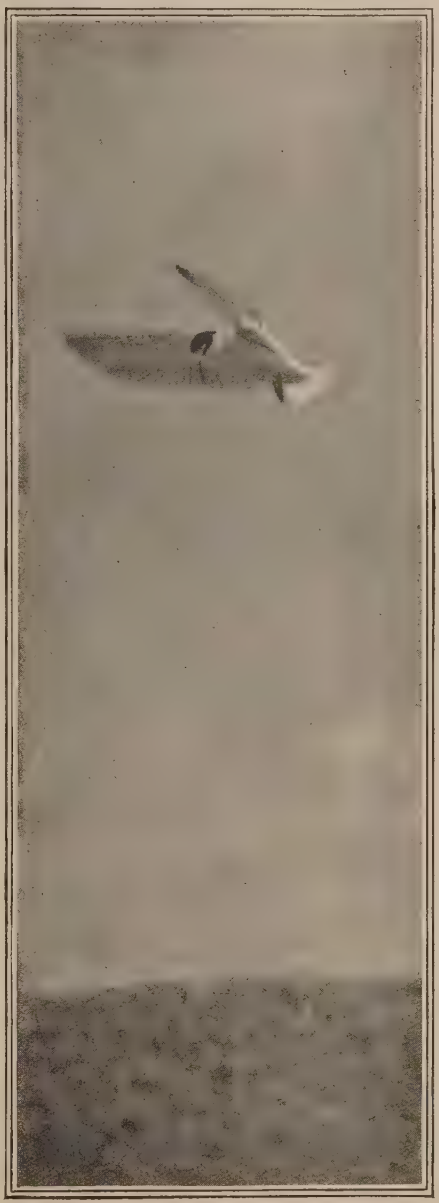


Photo: Capt. H. Morrey Salmon, M.C.

Lesser Tern hovering. It has been shown that all natural wings act as screws, in that they twist in opposite directions during the down and upward strokes.

Photo: R. Chislett, F.R.P.S.

A Corncrake on her nest built under a bramble where the spreading shoots were entangled with the grass of a hayfield. From the meadow a "run" had been worn by the regular passage of the birds.

41.—THE CORNCRAKE, OR LANDRAIL

By RALPH CHISLETT, F.R.P.S., M.B.O.U.

EVEN to dwellers in country districts where corncrakes are numerous, the name seldom denotes more than a somewhat unmelodious voice which is heard in the fields, mostly at night, during spring and early summer. Occasionally in the evening when sauntering down a lane, a glimpse may be caught of the head and neck of the producer of the strange sound as the bird peers at us through the thin upper fringe of grasses beyond the hedge; but it will only be for a moment. Sometimes, when startled, the corncrake may even be surprised into a rather laboured flight, but a close view, near enough to permit of any detailed examination, is rare.

In the north of England, where the residential parts of the towns are spreading ever farther along the highways, often leaving avenues of arable land between the rows of villas, the corncrake's voice may be one of the first country sounds with which the new inhabitants become familiar. It is remarkable how long this bird will yearly resort to fields and valleys which have thus become surrounded by houses.

People transplanted from areas of brick and mortar who are unfamiliar with birds, are apt to divide those which force themselves upon their attention into two classes—those they like, and those they dislike. The soaring skylark and the piping thrush are looked upon as friends. But the corncrake's rasping voice irritates the sleepless, and the bird is usually disliked. The youths of such neighbourhoods, daring the farmer's wrath under cover of dusk, will scramble through the hedges and endeavour

to locate this " nightingale of the fields." As they approach the direction of the voice it ceases for a moment, to be heard again presently from quite another direction. Ventriloquial the sound is said to be, but this reputation is no doubt due to the bird's running powers. The youths usually tire of the game first ; and no damage is done, except to the farmer's crop.

From the beginning of May until July the cry is in evidence, after which the corncrake is generally forgotten for another year. Sportsmen may meet with the bird in September and October, sometimes in parties, but most of the species leave England during the latter month, en route, by easy stages, for Mediterranean countries. A few birds may stay in southern countries through the winter, though the latest date on which I myself have seen them was in November.

If we consider the bird which is thus able to run at considerable speed through long grass or growing corn, we recognize the suitability of its wedge-like shape. When running the head and beak are stretched out ; then, from the beak to the widest part above the legs, the " wedge " increases in thickness and decreases again more rapidly to the end of the short-pointed tail. In colour the upper parts are of different shades of brown, buff and chestnut, with some darker striations. From above the eye to the neck is a band of bluish grey ; the cheeks, throat and chest are of similar shades of ashy grey, while the bill and legs are brown.

The following notes concerning a pair of landrails which had made their nest close to the boundary wall of a hayfield, may be taken as typical of the species in general, although the precise location of the nest was a little unusual.

Below the wall a spreading bramble entangled its shoots with the grass of the hayfield. From the meadow to the bush was a " run " worn by the regular passage of the birds through the grass. At the end of the run was a little chamber a foot in width, on the floor of which a number of grass stems had been placed crosswise and pressed into hollow formation, and on this five eggs were reposing when the nest was first seen. The eggs were creamy-clay in ground colour, sprinkled with dots of reddish brown. Seven days later, seven more eggs had been added, making the full complement of twelve, and incubation must at that time have just begun. Generally, clutches vary from eight to a dozen eggs. On the fourteenth day thereafter, a hide having already been in place for a week, photographic observations were begun.

Circumstances of lighting had made it necessary for the hide to be fixed over the run by which the birds usually approached from the field ; so by this time another beautifully arched run had been worn, curving from the rear of the nest into the field. At noon it was evident that the eggs were due to hatch, since several of them were seen to be cracking at the larger ends, and the imprisoned chicks could be heard quietly working inside. As the corncrake suddenly made its appearance from the cover of the long grass, a strong sun richly illuminated the chestnut markings on the back, and the bird appeared quite attractive. First it faltered slowly for a few steps towards the hide, then turned and walked quickly on the nest from in front, the only time it did so. After stirring up the eggs with its beak, the corncrake settled down and began to

Photo : Riley Fortune, F.Z.S.

The Corncrake's clutch of eggs are usually from eight to twelve in number, creamy white, and sprinkled with dots of reddish brown.

pull at the herbage which had been parted to obtain a clear view for the camera. Then, not liking the sun's direct rays, the bird retired to the shade just beyond the back of the nest, and remained there except for a few visits to turn the eggs. The chicks, however, required little assistance, and several were seen to hatch, and The brooding landrail itself looked very bedraggled. No change had occurred during the night, but during the morning all the remaining eggs hatched but one, which proved to be infertile and was left in the nest when the family was led away.

For some weeks after hatching, young corncrakes are led about by their parents,

Photo: Ralph Chislett, F.R.P.S.

The peculiar wedge-like shape of the Corncrake enables it to run at great speed through long grass or growing corn. It may be that its running powers are responsible for the bird's reputation as a ventriloquist.

soon afterwards to crawl over the back of the nest to their parent, in answer apparently to the calls she constantly uttered. These calls were quite distinct from the ordinary "crake," some being quite shrill and others subdued, brooding sounds, but the harsher cry of the mate occasionally sounded from the midst of the meadow, for a few seconds only, as is usual by day. By evening five of the eggs had hatched.

Heavy rain fell during the night, and at 6.30 on the following morning the eggs, chicks, and centre of the nest alone were dry. learning to pick insects from the grass stems, and are brooded at night precisely as the chickens of the domestic fowl are cared for. Their down is brownish black in colour, but has given place to feathers by the time the age of six weeks is reached. During this period the adults' raucous cry is seldom heard.

Few birds are more beneficial to the farmer than the corncrake. Though seeds of grasses have at times been found in the stomachs of birds dissected, its food consists almost entirely of insects and their

Photo: Ralph Chislett, F.R.P.S.

BROODING AFTER RAIN.

Heavy rain fell during the night, and in the morning the chicks and the centre of the nest alone were dry. The Landrail herself looked very bedraggled.

larvæ, with such unconsidered trifles as earthworms and slugs.

In many districts of late years corncrakes have decreased in numbers. Preferring to nest as they do in June, in the midst of hayfields, and even in cornfields, both eggs and young are constantly destroyed by the modern reaper. The diminution in numbers is certainly most marked in the plains and valleys where the hay harvest is early, and coincides with the landrail's nesting season. In hilly parts of the country, like the Derbyshire Peak, the Yorkshire dales and coastal regions, Cumberland and Westmorland, and in Scotland, even to the Hebrides and Orkneys where the species is especially numerous, there appears to be little diminution in numbers. In some districts from which the bird has been absent for years, however, it has reappeared in increased force; though whether such occurrences are due to the chances of migration or to the spread of surplus corncrake population from districts where conditions have proved favourable to increase, is at present unknown.

Outside our islands, in the breeding season, the corncrake's range extends over Europe from the Pyrenees, which appear to be its southern boundary, to northern Scandinavia. Asiatic countries from north Persia to eastern Siberia are also visited. From America the bird is absent, although several times individual birds, wanderers no doubt from Europe or North Africa, have been known to reach the north-eastern coast. That a bird which displays in this country such a disinclination for flight, preferring the use of its legs to that of its wings, should thus cross the broad Atlantic is very remarkable. The usual migratory route from North Africa by way of Spain and France calls for no such sustained flight, although a journey undertaken mainly overland by easy stages may offer perils quite as real as those of an extended flight overseas. In these, possibly, may be found at least a partial cause of the numerical fluctuations to which I have referred; for the landrail is said to be "good eating."

As the Corncrake suddenly made its appearance from the cover of the long grass, a strong sun lit up the chestnut markings on the back, and the bird appeared quite attractive.

GREEN WOODPECKER AT ITS NESTING-HOLE

Photograph by J. T. Newman

"SUSPICION"

A Green Woodpecker takes a look round

Photograph by A. M. C. Nicholl, M.B.O.U.

HOW HIS TAIL HELPS THE GREEN WOODPECKER

The value of the tail as a supplementary support is here clearly shown

Photograph by Henry Willford

"HIS FIRST CLIMB"

A young Green Woodpecker makes his start in life

Photograph by A. M. C. Nicholl, M.B O.U.

42.—A REPUTED WEATHER PROPHET: THE GREEN WOODPECKER AND HIS WAYS

By FRANK BONNETT

LARGEST and most conspicuous of the three British species of woodpecker, the "yaffle," as Hampshire folk call him, or the "gallibird," as he is known in Kent and Sussex, is an elegant and remarkable bird. Every bird-lover, of course, knows him by sight, for he is anything but uncommon, though he lives chiefly in dense woods where his livelihood is most easily obtained. But even those who do not get the opportunity of making his acquaintance at close quarters must be familiar with his merry laugh, if they do not always recognize him in that other liquid cry of his which has been interpreted as "*wet, wet, wet.*" For the woodpecker is credited with being an infallible weather prophet, though it may be that he is neither better nor worse than others who daily risk their reputation in issuing forecasts as to the vagaries of our climate. Be that as it may, the countryfolk are firm believers in the woodpecker's weather wisdom, and as sure as he begins to "holler," will lay their plans for rain. Certainly he is often right, and if he does make a mistake sometimes, he errs, at any rate, in the best company.

Photo: F. T. Newman.

A Green Woodpecker just out of the nest. He is not a good walker, for his feet are fashioned for climbing, and clinging to, trees.

But why, after all, should the green woodpecker be so concerned about the weather and be credited with knowing so much about it? If one may judge by his merry ways and his habit of laughing so perpetually when (so far as mere man may discover) there is nothing to laugh about, and his generally happy-go-lucky demeanour, one might suppose that it mattered very little to him whether it were fine or wet. No one ever heard of a yaffle going without his breakfast because it rained—indeed, one has often seen him during a heavy shower busily investigating the possibilities of an ant-heap in the meadow. If he wished to keep dry, he might just as easily have been regaling himself with some of those other "small deer" that are to be found at any time in the sheltered places of the wood. But there can be no doubt that of ants and "ants' eggs" the woodpecker is inordinately fond, and the gratification of his desires in this direction may perhaps be at

any time sufficient compensation for the discomfort of a wet jacket.

If, then, the yaffle chuckles boisterously for fine weather, and shouts less merrily for wet, we may take it that this is just his way of showing his superior knowledge of meteorology and not necessarily any indication of his personal feelings. He is, when you come to think of it, just the sort of bird to take a little innocent pride in showing-off.

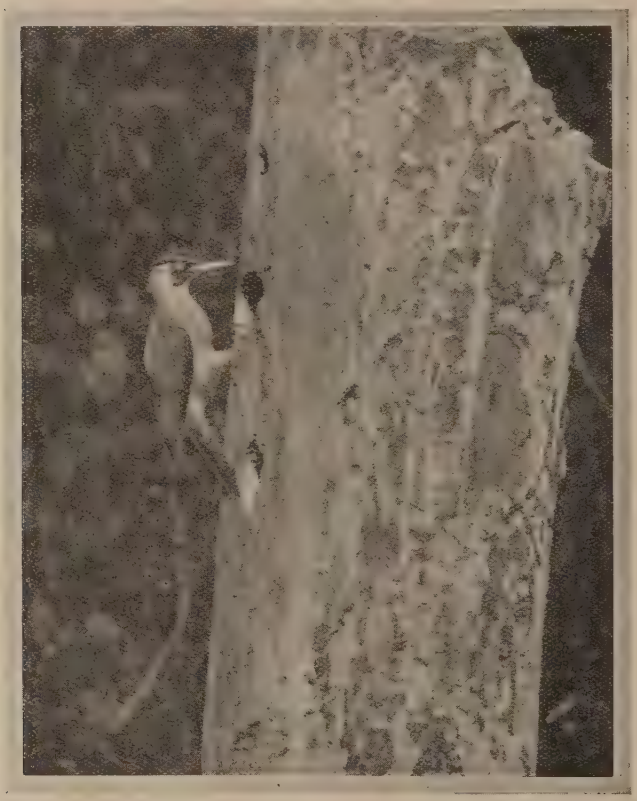


Photo: A. M. C. Nicholl, M.B.O.U.

The Green Woodpecker arrived at the nesting-hole pauses on the doorstep a moment before entering.

And, after all, the woodpecker of all birds may be forgiven if he be a little vain! He is endowed with so many privileges that he is not to be condemned if he gives one the general impression of being somewhat pleased with himself and his accomplishments. For Nature has not only endowed him with a handsome exterior, but she has seen to it—for some reason best known to herself—that he should be provided with as wonderful an equipment as ever bird enjoyed. From the tip of his strong, black beak to the extreme point of his stiff and eminently useful tail, the yaffle is a remarkable embodiment of use and ornament. Gay though his plumage be, the colours are wonderfully adapted to harmonize with the woodland he frequents, the blending of greens and yellows being a work of art which many an artist has tried to reproduce—not always with success. His red crown—which is common also to the smaller of the other two species, the greater- and the lesser-spotted woodpeckers—lends an air of distinction to an already striking personality; but even here Nature has been careful not to make it too conspicuous. A dull crimson would, perhaps, best describe its colour, but in the subdued light among the trees it takes on a much darker hue, and by its very contrast with the rest of the plumage creates that camouflage effect which is so useful. But one is still inclined to wonder why Nature thought it necessary to endow the green woodpecker with this extra bit of colouring. In the case of the other species, whose plumage is mostly black and subdued white, there was, perhaps, more excuse for this finishing touch of elegance, but the yaffle might have been satisfied, one would think, with the gaiety already accorded him.

As for his structure, Nature's first concern was to adapt the woodpecker to the mode of life that had been ordained for

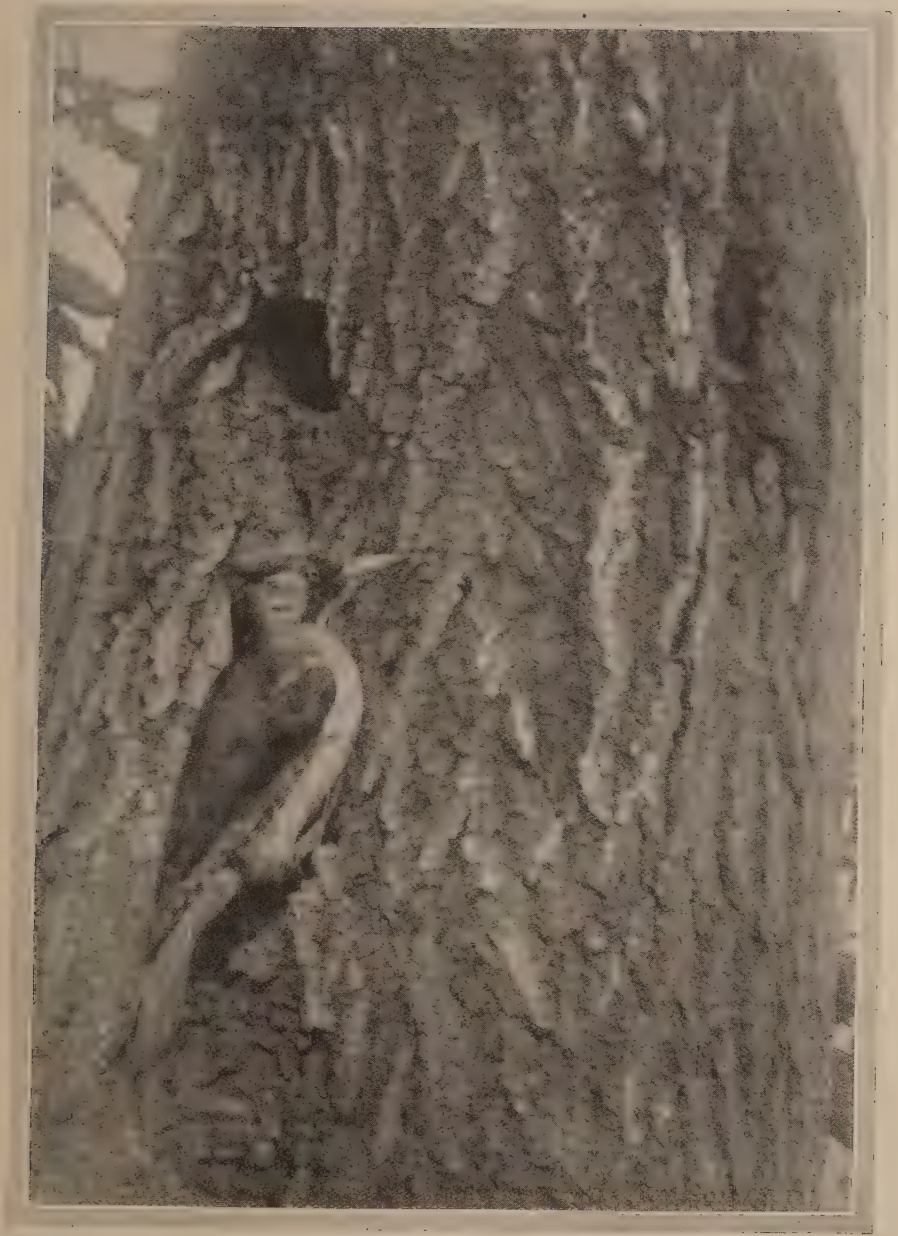


Photo: Henry A. Wallace.

GREEN WOODPECKER HUNTING.

The insect lurking far back in the crevice of bark is never safe: once it is impaled on the sharp point of the bird's tongue there is no chance of escape.

him, and in this she was lavish. She did not make of him in form so handsome a bird as many others, for when at rest he is not a bird of entirely gainly proportions. But he is graceful on the wing, with that characteristic flight of his—a few quick flaps of the wing followed by a sudden rise and a gradual fall—that can easily be identified half a mile away. But he was never,

Photo: A. Brook.

The crimson head of the Green Woodpecker appears at the nesting-hole; he takes a look round before venturing out.

perhaps, meant for a ground-frequenting bird, albeit, the lure of the ants' nest, which he cannot resist, brings him to earth on occasion. He is no good at walking, for his feet were fashioned for climbing, and clinging to, trees. That is why his claws are arranged parrot-fashion—two in front and two behind. His tail, too, is well adapted to its purpose—that of acting as a supplementary support to his body. The feathers are stiff to their very tips and pointed, so that they dig like spikes into the bark. Further, the yaffle's tail is curiously hinged so that he can tuck it beneath him, contrary to the arrangement provided for more ordinary birds.

But the woodpecker's tongue is, perhaps, the most remarkable of his attributes. It is controlled by muscles which pass round at the back of the skull, and is so wonderfully adjusted that it can be darted or withdrawn at lightning speed and with unerring aim. The insect lurking far back in the crevice of the bark is never safe, even though the point of the woodpecker's beak may be some inches away; and once the hapless creature is impaled on the tongue's sharp point, there is no chance of escape. If, indeed, the tongue be examined closely, it will be seen that towards its end there is a series of serrations which, acting like the barb on a fisherman's hook, make it impossible for anything, once firmly pierced, to wriggle off.

What good use the yaffle can make of his beak anyone may see for himself in the course of a walk through the woods. No oak was ever yet so hard but that the woodpecker could pierce a hole in it. It may be a slow process, but sooner or later the incessant blows of that sharply-pointed hammer will reduce the solid wood to pulp, and a passage —so neatly cut and rounded that it might have been fashioned by a carpenter with his gouge—will have been effected. What prodigious strength there must be in those muscles that drive the woodpecker's hammer!

Usually, of course, the yaffle will bore a hole only in some tree that is rotten at the core, but the work, before he gets to the softer part, is as hard as if the whole trunk were sound. It is an easy job to bore into a tree that is dead and far decayed, and such a tree may sometimes be found riddled with holes, while the ground beneath is strewn inches deep with the chips of rotten wood. A tree like this beneath whose surface grubs and other insects lie hidden, will keep the woodpecker and his family busy for months on end, nor will they leave it until they have explored its innermost recesses and hollowed it out, perhaps, until nothing but a skeleton remains.

For his nest, however, the woodpecker will not choose a tree so far gone in decay as this. He and his mate will spend much time, we may be sure, in prospecting, until at last by repeated tapping tests they find one that is sound without but decayed within. A rotten trunk, which might snap off at any minute, is not to be trusted in such an important matter as this, nor will a per-

fectly sound one answer the purpose because of the labour involved in hollowing the nest.

But even the yaffle, if we may judge from appearances, is not infallible in his choice of a suitable tree. Sometimes one may notice a hole begun and left unfinished as if the bird had discovered, after penetrating a few inches, that the heart was not so soft as he had supposed, and that the work of boring would be too great. It may be that the sound of the wood when tapped is apt to be deceptive. Sometimes one or more abandoned attempts may be noticed near the point at which the hole is finally made; on other occasions the tree is abandoned altogether as being, apparently, too hard to tackle.

Once the passage to the interior of the trunk is effected, the woodpeckers, if their choice has been wise, will waste no time in excavating the hollow for their nest. It is a simple business, for the nest is no more than a chamber large enough for the eggs and the sitting bird, with some extra space to allow for the growing brood. Nothing more than a few chips of soft and rotten wood is used for a lining to the nest; and nothing, indeed, is more suitable. If the site prove satisfactory and the birds are allowed to rear their brood without molestation, the same home will be tenanted year after year by the original founders, or at any rate by some loving couple of the ancient order of green woodpeckers.

Neither the greater-spotted nor the lesser-spotted species of woodpecker, which complete the family trio so far as Great Britain is concerned, is nearly so familiar as their larger cousin, the yaffle. Both species are local, and the greater-spotted is probably a good deal the rarer of the two. The male of the larger species, though having the crimson crown when young, loses it later except for a small patch on the nape, There is a dash of the same colour on the abdomen. In the smaller species the crimson crown is retained and the white wing-bars are extended right across the back. In the adult females, the larger species has a black crown; the smaller, a white one. The spotted woodpeckers, perhaps, are rather less fond of the woods than the yaffle, and yet they are much less often to be noticed by the average observer. This is chiefly because of their more retiring habits,

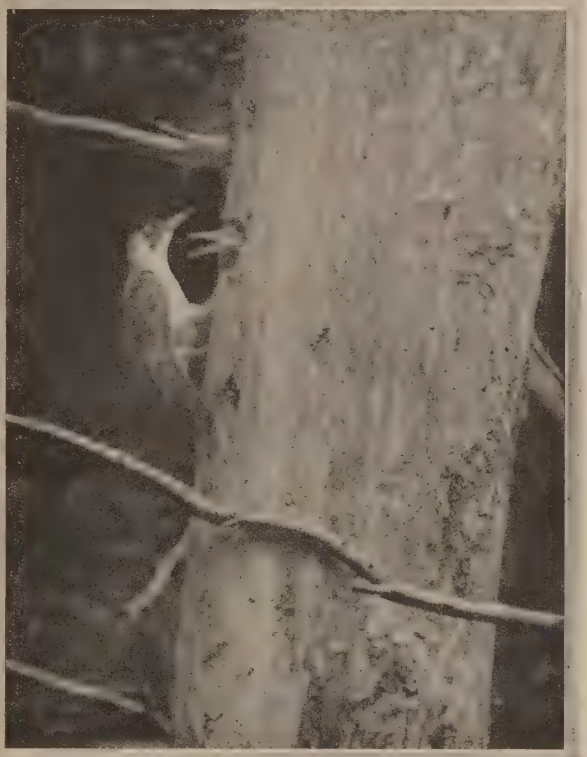


Photo. A. M. C. Nicholl, M.B.O.U.

The nesting-hole of the Green Woodpecker is the scene of many domestic anxieties. An impatient youngster makes a pointed request for more food!

for even at close quarters it is easy to overlook the spotted woodpecker because of its camouflage dress. Compared with the yaffle, too, these are silent birds, never shouting aloud from the tree-tops or flying boldly out into the open. But if one is alert

Photo: Henry Willford.

The Greater Spotted Woodpecker is generally to be found among the elms, but he is a much less brightly coloured bird than his cousin, the Yaffle, and therefore is very easily overlooked.

one may hear them call from time to time, especially in the nesting season. Their call is sharp and short, and not very penetrating—very different from the loud, almost vulgar, cry of the gallibird as he goes rejoicing on his way.

Nor do the spotted woodpeckers appear to revel in flight as does the merry-hearted yaffle. They follow his mode of progression through the air, and in this way can be identified easily enough, but instead of taking long flights across the open, they content themselves with short journeys from tree to tree. If it be desired to find the spotted woodpeckers at home, the surest place to seek them is among the lofty elms, but it will be necessary to scan the upper branches closely—preferably with the aid of a pair of glasses—or failure to pick out the black and white chequered plumage that harmonizes so perfectly with lichen-covered bark will certainly be experienced. The larger of the two species confines his activities almost entirely to the tree-tops, but the smaller bird is sometimes to be met with in the orchard where, without doubt, he is to be reckoned as a good friend to the fruit-grower. Like the busy little nuthatch, he is for ever at work, and the number of injurious insects that he destroys in the course of a twelvemonth must be prodigious. All the woodpeckers, in fact, are to be regarded as useful birds, and this fact is sufficiently well appreciated by the majority to prevent any determined persecution at the hands of man. For all that, there was once a Surrey keeper—a cockney, it is true—who assured the writer that the green woodpecker was an enemy to game, in sole support of which theory he instanced the size and strength of the beak of this carnivorous monster! It had never occurred to this genius that strong beaks might have other uses than the murdering of young pheasants, but, fortunately for the yaffle, there are not many so ignorant as this unhappy man. Those strange people who are minded to admire a poor stuffed and distorted creature in a glass case in preference to living beauty will always be responsible for the slaughter of a certain number of gallibirds each year, but for the most part our gay and gallant knight of the woods is suffered to go his way in peace and happiness. And well it is, for if he were ever to become uncommon, we should sorely miss—winter or summer, rain or shine—the merry echoes of the laughing woodpecker.

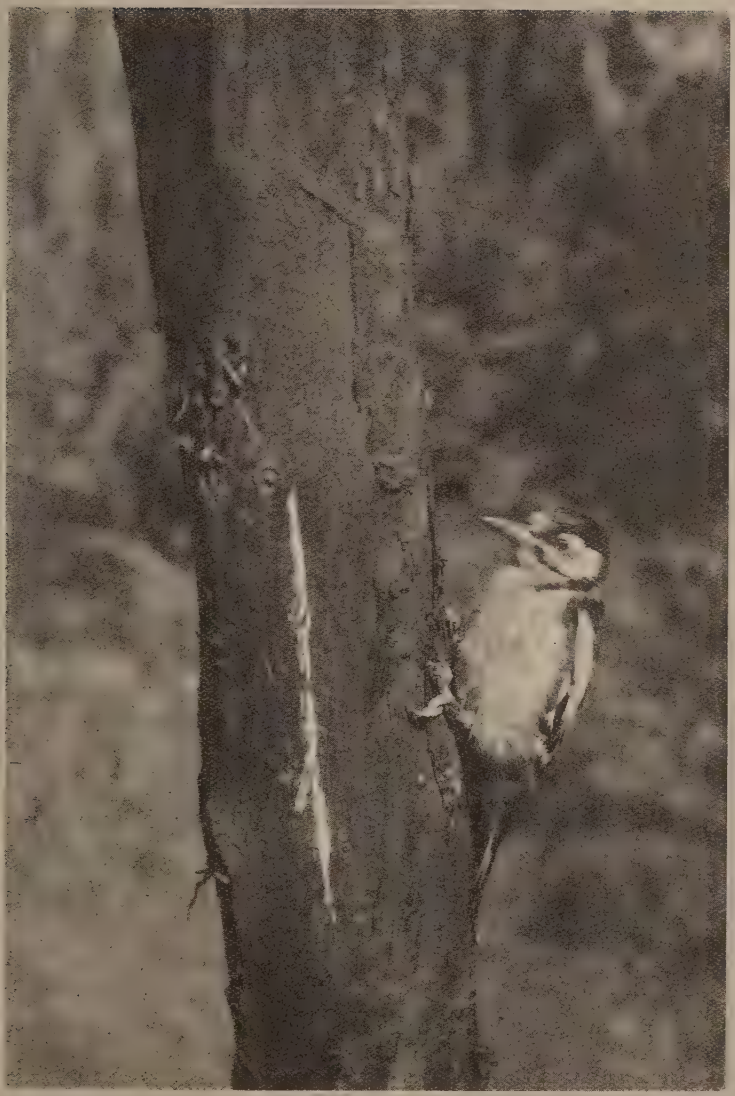


Photo: Stanley Crook.

YOUNG GREAT SPOTTED WOODPECKER.

Note the long, sharp claws and the stiff supporting tail.

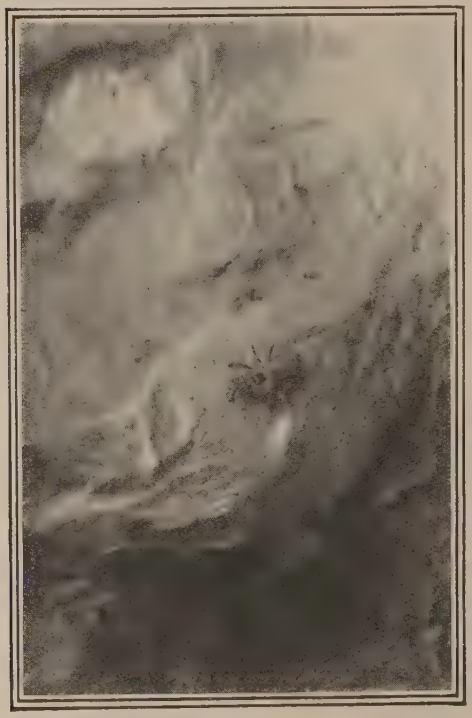
The World of Spiders

2.—THE BRITISH TRAPDOOR SPIDER

By EDWARD STEP, F.L.S.

With photographs by Hugh Main, B.Sc., F.E.S.

ALTHOUGH one of the most interesting of our native spiders has long been known as the British trapdoor spider (*Atypus affinis*), it cannot be said to have a very strong claim to the popular title. It is true that it is a representative of the family that includes the true trapdoor spiders, and that up to a point the style of architecture adopted is much the same; but the species that are found around the Mediterranean, made famous by Moggridge fifty years ago by means of his book "Harvesting Ants and Trapdoor Spiders," render their underground retreats secure by constructing a hinged door to the entrance, contrived either like a wafer or like a bung, in the latter case with a proper bottle-neck for it to fit into. In either case the name is very appropriate; but with our native species there is no door of any kind, and the spider can only get out or pull a victim in by tearing a rent in the aerial prolongation of her underground home. But though the name appears to be a misnomer when applied to *Atypus affinis*, when we note how closely her personal structure and general appearance agree with those of the species that do construct actual trapdoors, we do not feel that we can withhold the descriptive title from her.

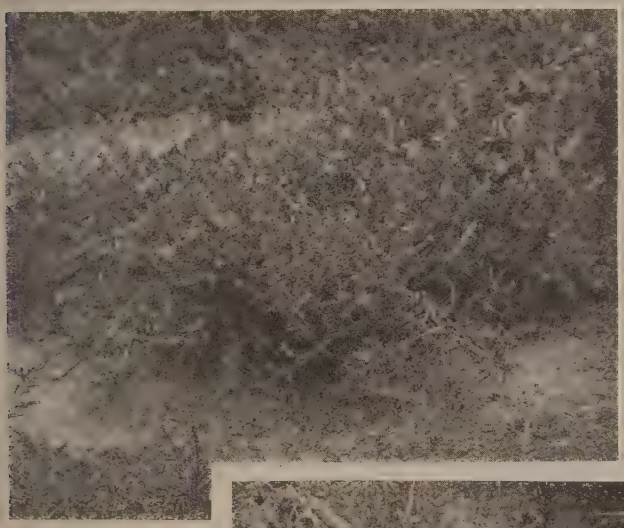


A newly hatched British Trapdoor Spider. This spider does not make a hinged door as does its relatives around the Mediterranean, but has earned the name because it closely resembles them in appearance. (× 4.)

Insects have three well-marked divisions of the body; but in all the spiders there are only two parts—the head and thorax being united. In most spiders this fore-body (*cephalothorax*) is small in comparison with the hind-body or abdomen; but in the trapdoor group there is not a great difference in the proportions of the two parts, and what actually exists is disguised by the large size of the fangs, which our eye accepts as part of the fore-body.

The female atypus is brown with paler legs, her fore-body bare and glossy and the hind-body covered with short hairs. Her entire length, including the retracted fangs, is a little more than half an inch, so that she ranks among our larger spiders. The four pairs of legs are all stout and relatively short; and one would deduce from her

build that she is not given to running over grass tips or an openwork web of delicate threads. Legs and all, she measures nearly an inch. The male is much smaller, as the rule is among spiders; he has longer legs and his coloration inclines strongly towards purple.



The fangs to which I have referred are known technically as "falces" from their hook shape. In most spiders these have their sharp tips opposed, and work in a horizontal plane; but in atypus they are side by side and work up and down. The importance of this variation will appear later. On the outside of each fang will be seen a more slender jointed appendage, known as a palp or feeler. In atypus these are so long that when in use they are in danger of being counted as legs by those who forget that one of the most conspicuous attributes of spiders is the possession of four pairs of legs, whilst insects have only three pairs. The pair of spinnerets, from which silk in a liquid condition is paid out, will be seen projecting from the extremity of the hind-body. The eyes are in a curved row on the top of the head and just behind the falces. There are four large ones in this curve, and behind each of the end ones is a pair of small eyes —making eight in all.

The discovery of atypus as a British spider is credited usually to Joshua Brown, who found it near Hastings in 1856; but Leach had discovered it at

The home of the Spider is in sandy places where there are banks covered with heather and gorse. In the upper photograph the tube is just discernible in the centre; the lower photograph is an enlargement of part of the upper in the immediate surroundings of the tube.

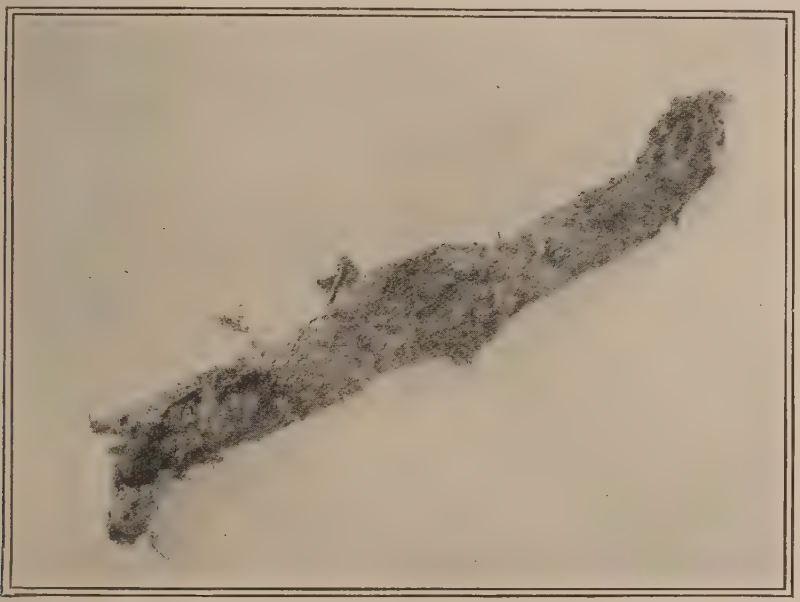
Exeter and in the London district nearly half a century earlier. Samouelle, in his "Entomologists' Useful Compendium," published in 1819, after reference to Leach, says "it has twice occurred near London." But it is to my old friend the late Fred. Enock, coming twenty years after Brown, that we are indebted for its real discovery—the laying bare of its secret history by many years of the most patient and persevering research. When he took up the subject in 1876 little was known of atypus beyond the two facts that it occurred in Britain and made peculiar silk-lined burrows. Enock hunted for it industriously in the northern outskirts of London, and was rewarded at last on Hampstead Heath, where his close searching made him for a time an object of suspicion to the keepers and the police. Later, he found considerable colonies of the spider at Woking; and more recently it has turned up at Oxshott in Surrey, at Eastbourne, the New Forest, the Channel Islands and in Ireland. A few years ago Mr. Hugh Main, F.E.S., to whom I am indebted for the photographs and additional particulars respecting the nests, found it in Epping Forest. It appears, therefore, that the former ideas that it was only an occasional, or at most

The English Trapdoor Spider lines its nest with a silken tube. Here the ground has been cut away, and the tube is seen running to a depth of some ten or twelve inches. (× 2.)

sporadic, resident here were due solely to the lack of search.

To become acquainted with atypus in an active living condition she must be sought for in sandy or gravelly places where there are banks crowned with heather, gorse or other enduring plants; and there is little use in looking for the spider herself, for she is a recluse—one of the shy, egg-cocoon or the large family of young spiders.

Main says: "The aerial portion of the tube may be found running either up or down hill. Probably in the first instance it is carried up-hill among the roots and along the ground, but the supporting threads may be accidentally disturbed and broken, and the tube then lies down the bank.



The tube of the English Trapdoor Spider is a skilful piece of work. First a narrow carpet is woven along the ground, and then by deft movements of the hind-body strands are carried across and across to form a skeleton roof. Later the skeleton is filled in with woven threads.

retiring creatures who have no passion for publicity. In this respect she is probably actuated chiefly by the desire to avoid making a meal for a lizard or a bird. The enquirer, having found a bank of the description mentioned, should look carefully along its surface and try to find a sand-coated silken cylinder, either running along the ground for two or three inches or descending a stem or stone. This is the aerial portion of the spider's home, which is continued underground to a depth, maybe, of ten or twelve inches. This buried portion has an expanded area towards the lower end—a provision, presumably, for accommodating the In captivity, I find the tubes are always carried up any adjacent objects whenever possible. In very hard ground the tube is generally shorter than when in loose earth."

This lower portion is the spider's home; the aerial portion is its hunting ground and snare. The structure is begun by attaching silken threads to a stem or stone, and weaving a narrow carpet along the ground for several inches; then, by deft manipulation of the hind-body, threads are carried loosely across from one edge of the carpet to the other to form a skeleton roof. This skeleton is filled in and strengthened by the weaving of threads in other directions until

it becomes a tube. Then the builder begins to burrow into the bank, extending the tube downwards, and bringing up the excavated material between her fangs. Grain by grain this is pushed through the meshes of the aerial tube, and by the tips

The tube opened, showing the Spider within. The aerial portion is its hunting ground and snare. (× ½.)

of the fangs pressed into position on the outer surface, where some viscidity appears to render them fixtures. The care bestowed upon this retreat is justified by the fact that it is no temporary dwelling, but a home for the life of the spider.

As begun in spring by the young atypus, it is, of course, a small affair, no thicker than a crow quill and of no great depth. But as the growth of the spider proceeds the dwelling is enlarged proportionately until its diameter is three-quarters of an inch. All the work is carried out at night, when operations are less likely to attract the attention of enemies. In the daytime the spider sits patiently watching just below ground level, and should any insect alight upon the exposed part of the tube the watcher has instant knowledge of the fact. Quickly but quietly placing herself beneath the spot occupied, the sharp tips of the parallel fangs are plunged swiftly through the silk and into the head of the loiterer. They are then folded to hold the victim, who is drawn into the tube. Being killed, the body is secured to the wall near the bottom of the tube, and the spider proceeds to darn the rent in the upper walls —an operation that takes about an hour to finish. Her method is to draw the edges of the rent together by means of her fangs, and when the tear is straightly and evenly composed she turns around and uses her spinnerets as fingers, drawing out fluid threads of silk and so applying them in the right places in order to make the repair perfectly neat. Then sand from the bottom is added and the darn becomes invisible.

In the spring, when the *Andrena* bees are busy looking for banks suitable for mining, and the parasitical *Nomadas* are equally busy watching the *Andrenas*, one or the other will alight for a moment on the sanded tube. That is sufficient an opportunity for atypus, who, instead of using the time-honoured formula, "Will you walk into my parlour?" pierces the victim with her fangs and drags it in. In summer there is an abundance of flies of many kinds that are constantly walking over everything, and enough of these alight on the fatal tube to keep the spider healthy and plump. In the autumn, when flies have become less plentiful, beetles and earwigs supply her needs.

Atypus has never any need to go hunting outside: her food comes to her day by day. Herein we see the reason for the sandy coat that is so carefully and laboriously wrought into the fabric of the trap. One might almost regard it as a deadly calculation on the part of the builder. A short-sighted bee or fly might blunder accidentally into a spider's snare that is stretched across the way between the branches, and an examination of the garden spider's web will show that this is happening hourly; but no insect will alight deliberately on a silken snare. The sand disguises the real nature of atypus's tube, and disarms the insect's suspicion.

In this way the young atypus fares sumptuously from April to November, when it begins a three or four months' fast—actually refusing food that may be offered to it. Through the winter it lies snug in the lower part of its home ; and as a result of this inactivity the upper story, being unvisited, loses its shape—stones and earth fall or get washed upon it, and by spring it is useless. So the spider's spring cleaning takes the form of constructing a new upper chamber branching off from the base of the old dilapidated one. Some old nests have four or five of these branch tubes, and these greatly puzzled the few earlier observers of atypus : they could not understand their purpose, until Enock made it clear from his experiences with a small colony of the spiders which he had established in his garden and maintained for many years. By the daily observation of this colony Enock was enabled to check the observations he had made in the wild, and gradually build up the life story of atypus.

Among other points cleared up, Enock was able to arrive at an approximate estimate of the length of the female's life—which he set down at ten years—and a fairly complete account of her family experience. The males do not enjoy long lives, and therefore they are not so numerous as the females. The sexes live apart during their early lives, each individual in a separate tube. When the young male has arrived at a marriageable age—about four years—he leaves his tube one night and goes in search of an eligible mate. He carefully examines the aerial tubes of his lady neighbours, and when he thinks he has reached the right one, he drums upon it with his feelers. Some special sense appears to inform him that in some cases it would be not merely useless but positively dangerous to call. From such tubes he departs in a hurry as though fearing pursuit and punishment. At length his drumming appears to be answered in a way that gives him confidence, and without further ceremony he tears a slit in the silken wall and boldly descends the interior. Occasionally he makes a mistake, for he has been seen to beat a precipitate retreat while the annoyed lady atypus at once set about the repair of her damaged wall. But when at length he receives the welcome for which he had looked, he makes a lengthy stay, extending perhaps to three or four months—in one instance recorded by Mr. Enock the honeymoon lasted for nine months.

This, however, was exceptional and opposed to spider nature. In the majority of cases one of the pair gets tired of the arrangement earlier. If it is the male, he manages to elude the vigilance of his partner and breaks through the wall of the tube as he did on his entrance. But few married males appear to regain their liberty : as a rule the female ensures the union being made a lasting one by a deed of incorporation. She eats her husband !

Female of the British Trapdoor Spider. In most spiders the fore-body is small in comparison with the hind-body, but in the trapdoor group there is not much difference between the two. (× 1.)

In the expanded part of the lower tube the female, about August, constructs a soft silken cocoon in which she deposits from 100 to 150 spherical eggs. These hatch a little later, and the extensive family of little ones remain with their mother all through the winter, the summer and the winter following. In their second spring a small hole is made at the top of the tube, through which the young spiders pass to the outer world and independence, each paying out a silken thread as it goes. They climb to the highest available point of the adjacent vegetation and wait for the wind to pick up their gossamer and float them away. Descending when this catches upon other plants, they make their way to the ground and begin the construction of new habitations, each for himself or herself.

Wild Flowers and Their Ways

17.—FROM FLOWER TO FRUIT—SOME TRANSFORMATIONS

By G. CLARKE NUTTALL, B.Sc.

With photographs by the Author

THE change from flower to fruit is one gradual process of development whose beginning lies in the tiny flower bud, and whose end is reached in the mature fruit with the scattering of its seed. The

How the Dandelion head becomes the "blowball" fruit. The orange rays close bud-like, then fall off in bulk. The silvery hairs which surrounded each floret are carried up on a fine stem, and opening like parachutes, all at one time, produce the airy "blowball."

flower is but a stage on the road, the most interesting and arresting, perhaps, as is some view-point on a journey, but only an episode in the chain of changes, and not an end in itself. Even when the flower is blooming there is always transition and development towards the goal of fruition—but what happens during the life of a flower is another story; here we are concerned only with what occurs when the flower fades and, so to speak, "dies."

Of course, there is no real death; the protecting sepals, the gay petals, the yellow stamens and the receptive column, their work done, are, more or less, discarded, but the heart of the flower, that case containing the newly-fertilized ovules, remains in full vitality, and like the soul of John Brown "goes marching on." And the march takes many and varied roads; before no two kinds of fading flowers does it lie exactly the same, though in family groups there are usually strong features of resemblance.

At this juncture there are two main objectives before the plant—the production of good seeds, and the provision of means whereby those seeds can each be started on a career of its own. Overcrowding among plants is on all-fours with overcrowding among men, it is equally bad for both.

The chief agencies by which seeds quit the neighbourhood of

their parents are: first, the ever-present and unfailing wind; second, in comparatively rare cases, water; third, the more "chancy" animal world; and fourth, but rather sub-

1. 2. 3. 4. 5.

The unattractive little flower "Honesty" has a minute flattened seed-case. When the flower fades the latter rapidly grows into a great flat plate, and drying, becomes silvery in colour. (The seeds can be seen within in stage 5.) Later it splits, and catching the wind like a sail, throws out its seeds.

sidiary, mechanical means of expulsion exerted by the plants themselves. Consider, then, types of these various classes, and watch the stages by which any given blossom transforms itself into a fruit. It is a transformation scene that well repays watching.

First note the yellow dandelion which, as was described in a previous article, is just a colony of many little flowers collected into one head. The wave of maturity begins at the outermost florets and gradually passes to those which are most central. This done, all the orange florets wither and close up together within the green sheathing bracts, so that at this stage it is rather like the bud. Soon there is the usual discard in bulk of petals, stamens and column; they can be seen coming off like a ball in the third stage in the photograph; nevertheless, growth is still going on inside those enclosing bracts, for round the petal tube which stood upon every seed-case was a ring of silvery hairs, and the top of this case is now rapidly growing into a thin stem which is carrying up these hairs all folded together like a closed umbrella. This is the fourth stage, and by this time the enveloping green bracts have shrivelled into nothingness. Then, one fine day when the sun warms

The Snapdragon slips off its gay corolla as a lady slips off a skirt, and the small rounded seed vessel grows into an object like a calf's snout, or a sheep's head. It dries, and the seeds rattle inside, and are finally jerked out by the wind through the holes at the top.

everything, all the hairs spread out together, and in place of the "swine's snout" there is a beautiful gleaming blow-ball made up of scores and scores of fairy parachutes, each carrying a seed as its passenger — one seed for each flower in the colony. A breath of wind and each seed loosens its hold on the end of the main stalk and floats away, upborne by its parachute, but it needs this impetus of the wind to give it a start. A dandelion blow-ball kept on the shelf of an ordinary greenhouse, though not protected in any way, will remain intact for months, until, indeed, some accident scatters it.

The insignificant, almost ugly, little flower of honesty, a plant so common in our gardens and so liable to escape as to seem at times a weed, is an example of plants that make an appeal to the wind in quite another way. At the very outset the minute seed-case in the centre of the flower appears a little flattened, but it gives no hint then of the lengths to which it is going in this direction. Yet no sooner are the petals withered than it begins to turn itself rapidly into a larger and larger flat plate, its green tissues drying more and more, losing their colour and becoming membranous, until it is like a silvery moon, and as flat as the moon *looks;* hence its botanical name of *Lunaria*. The various stages are shown in the photograph. In the flower the minute seed-case was divided parallel to its flat sides by a partition on which the seeds were fastened, and this partition, of course, keeps pace with the general growth. In the final stage of the fruit these three membranous layers (the two walls and the central partition) split apart and expose the seeds. Naturally the big flat plate catches the wind and sways to and fro, flicking the seeds off. Not only, too, does each fruit sway, but the collection of moonlike fruits on a spray act like sails, and the whole branch swings briskly under the urging of the wind and adds its impetus in the flinging off of the seed.

The Strawberry flower becomes the luscious strawberry fruit by discarding its petals, and by the end of the flower-stalk swelling up into a great succulent bed on which lie scattered the hard little yellow seeds.

The snapdragon, the poppy and various other plants, though providing neither parachutes, wings nor sails, yet require a little assistance from the wind. Watch the transformation of the snapdragon flower. Directly the great humble bees have fertilized it it just slips off the big corolla as a woman slips off a skirt; the stamens being fastened to it go with it, and there is a great drop in importance, for what is left is only the little still fresh sepals ringing the small seed-box and its upright column. This is shown in the third stage in the picture. But while the sepals and the column proceed to wither, the seed-box swells, dries and hardens into a curious object somewhat like a calf's head (hence the old name of "calves snout" for the plant), though Gerard, the Elizabethan botanist, comments, "In mine opinion it is more like unto the bone of a sheep's head that hath lain long in the water—the flesh consumed clean away." When quite dry, little teeth at the tip fold back and leave round holes—the orbits of the sheep's skull. One of these can be distinguished at the top of the last stage in the photograph. The seeds, small, black and shining, are lying loose within, and as the wind sways the long stalks

The changing of the Rose into the hip. On the fading of the flower the stalk-end grows up round the seeds, enclosing them as in a cell. It also becomes somewhat succulent and very brilliantly coloured. The birds eat the hip and scatter the seeds.

which carry tiers of these fruits, they are jerked out one after another through the holes. True, it is not very much of a dispersal, but, at any rate, the seeds do not fall into a single heap beneath. The capsule of the poppy, which has a ring of holes just beneath its lid, jerks out its seeds in precisely similar fashion as it swings censer-like in the breeze.

When we watch the white flower of the strawberry changing itself into the luscious berry—" God's own berry "—we are witnessing rather a strange transformation. The petals fall one by one, leaving the five green sepals intact. These close up round the centre of what was the flower, just a little hard mound, the end of the stalk, on which are crowded

The Pansy begins its transformation by folding its withered petals round the seed-case. The seed-case swells and dries; the petals disappear. Under the influence of the sun the capsule splits into three, disclosing a double row of shining black seeds. These are nipped out in order one by one, by contraction of the walls. The Pansy and the Wild Heartease are precisely alike in their transformation

together many minute green bodies, each containing a seed. These bodies remain intact; nothing happens to them as to their brethren in the dandelion and the snapdragon, but the little stalk mound begins to swell and becomes juicy and red, and the seed-cases, now yellow and harder, are carried out on its surface as on a great bed. It is rather amusing to find that this most prized of fruits is really a "false fruit" in the opinion of the botanists, because its toothsome succulence is derived from the stem and not from the flower itself. Obviously, here the plant's appeal for assistance in the dispersal of its seeds, and a particularly strong appeal too, is to the animal world. It has no use for the offices of the wind.

Next observe carefully a rose transforming itself into a hip, and again there are curious happenings to chronicle. In the very centre of the flower is a cup, really a depression in the end of the stalk. From its margin rise the petals and the stamens, while growing within it are a number of white hairy objects, one seed in each. When the fragile petals fall after their two-day life, the cup begins to grow, and as the photograph shows, gradually surrounds and encloses the fruits, meanwhile becoming somewhat succulent and more and more brilliant in colour. Eventually the transformation into the hip with its shining, scarlet skin and bright yellow flesh in which the fruits are now embedded, is accomplished. The birds care little that the botanists call it "false," and come to it in great numbers. The smaller ones peck at it and often leave it half-eaten upon the branches, scattering the fluffy fruits around. Bigger birds, like the blackbirds and thrushes, eat the hips whole, digest the fleshy part and pass out the small hairy seeds, dropping them far and wide. In such fruits as the cherry and the plum it is the walls of the seed-case itself that become succulent and edible, so these are called true fruits, though the plant itself in achieving its aims recks nothing of these subtle distinctions.

In the centre of the Geum flower are a number of distinct seed-cases, each containing a single seed and surmounted by a fine column. When the petals fall, the end of the stalk rises into a mound, and each column forms a hook which attaches itself to any passer-by. The Geum really seeks to get surreptitious aid from the animal world.

Then there are other plants which also wish to enlist the animal world in their service, but they make no inviting appeal on the gastronomic side; rather they act in a surreptitious way and steal the assistance they require without any *quid pro quo*. Here is one of them, a geum (the little herb Bennett is the geum of our hedgerows). In this type of geum every seed is in its own small case, all quite distinct, in the centre of the flower. When the petals fade the flower stalk-end grows up into a little mound and carries up the seeds in their cases each with its column on top. Meanwhile the top of the column has been gradually forming into a small hook—the evolution can be seen in the photograph—which hook will fasten on to any fur, feathers or feet of animals or birds that may happen to come its way. The seed-case is dry, and, by now, very lightly attached to the mound, so that at the slightest pull it comes away and is carried along by the passer-by until

some accident rubs it off and leaves it to its fate.

One most striking and curious transformation scene must be noted here, and that is the transforming of the cyclamen flower into the cyclamen fruit. When the quaint flower with its five turned-back ears fades, the petals, being united, fall off all together and the flower-stalk begins to roll up like a watch-spring, getting shorter and shorter until it lies in a coil on the ground, the seed-case in the centre. Still the shortening goes on so that, at last, the seed-capsule has been drawn right into the ground, and there it lies all through the winter days. When summer comes the drying of the stalk tugs it out of the ground again and then the stem rots off, leaving a claw-like bit attached to the capsule. This claw seizes upon the foot of any bird or animal that walks on it, and the case of seeds is carried off, meanwhile opening and discharging its seeds. The cyclamen is not really a native of this country, but it has established itself in various parts, *e.g.* Kent, and it is now included among the wild plants of the countryside.

The proceedings of the Cyclamen are very striking. When the flower fades the stalk winds up like a watch-spring, and the seed-case is dragged underground for the winter. In the summer following, it is dragged out, and the dried stalk forms a claw which attaches the capsule to any passer-by. (Inset.)

When we turn to the heartsease (*Viola tricolor*)—in its garden form the pansy—we come to one of that class of independents that rely on no outside agency, but prefer to manage their own affairs themselves. The quaint coloured petals wither and close so that they look very much like a bud again. The rounded seed-case, ribbed in three places and full of seeds, grows considerably as it dries. Then, one fine day, under the persuasive influence of the sun, it suddenly cracks along the three ribs and opens out, and in each of the three divisions lies a double row of tiny, shining, black seeds. Next, the walls gradually contract and nip out the slippery, shining seeds with much the same force, says Kerner, as one flicks a cherry between finger and thumb, and out they go in regular order one after another, beginning with the outermost one, until only the bare walls remain. Moreover, the first division is emptied before the second begins, and so on in rotation.

The balsams are also "independents," but of a more sensational order. They end up their transformation series with a veritable explosion, hence their botanical name *Impatiens*, while our common balsam is called "Noli-me-tangere," because, when ripe, it will not bear the slightest touch without promptly exploding and flinging out its seeds. There are quite a number of these "sling fruits" among our plants; for instance, there are mild forms in the wood sorrel and crane's bill, while the broom pods burst and throw out their seeds with cracks so loud that they can be heard some distance away.

From these few hints of typical cases it is obvious that, since there are flowers of endless variety, all with varying transformations into fruit, we have here a wide field observation for those who have patience to watch developments, and are not content with merely recording results.

18.—HOW DID THEY GET THERE?

PROBLEM OF THE LUSITANIAN FLORA

By S. LEONARD BASTIN

With photographs by the Author

ONE of the strangest problems which the botanist has to consider is what is known as the discontinuous flora. Here and there, on this earth, are to be seen groups of plants in widely separated spots between which similar species are not found at all. A typical discontinuous flora is seen in the Alpine plants, which, all the world over, have many characters in common. Anyone who ascends a mountain in the tropics will, when he arrives at a certain altitude, find that the vegetation is very similar to that on the Alps. Yet, in the intensely hot climate down below, these plants could never exist, and they are just as much separated from their kind in other parts of the world as if they were on an island. To understand the existence of these Alpine plants we should need to find out a great deal about the past history of the world, not only so far as the contour and level of the land is concerned, but also the great changes of climate which our earth has undergone.

An even more curious question than that of the Alpines is suggested by what is known as the Lusitanian flora in the British Isles. In the south-west of England and in the west of Ireland there flourish certain plants which do not occur elsewhere nearer than Spain or Portugal. On this account the term "Lusitanian," from Lusitania, the old Latin name for Portugal, has been applied to these plants. Some of the most important of the Lusitanian species are amongst the following: The strawberry tree (*Arbutus unedo*), common in gardens in the south of England, but really wild on the shores of Killarney; several typical Pyrenean heaths, such as *Erica mediterranea*, *E. Mackayi* and *Daboecia polifolia*, all abundant in the west of Ireland; the Cornish heaths, *E. vagans* and *E. ciliaris;* London pride (*Saxifraga umbrosa*); two butterworts, *Pinguicula lusitanica* and *P. grandiflora*, the first common in the west of England, and the second to be found in Cork and Kerry. Other species belonging to the Lusitanian group include an orchid, *Habenaria intacta*, which occurs in Galway, the *Lobelia urens*, found in Devon

The Lusitanian plants which are found in the shaded districts of this map present an interesting botanical puzzle. They seem to have wandered from the south of Europe, leaving out the countries in between.

and Cornwall, and the Irish spurge (*Euphorbia hiberna*).

Now all these plants are typical of a warmer climate than is common over the greater part of our islands. These southerners only contrive to exist in the comparatively mild south-west, where severe cold is almost unknown. How can we account for their presence with us at all, separated by hundreds of miles of ocean from their relatives in sunny Portugal? There is just a possibility that the seeds of the arbutus enclosed in an attractive fruit may have been brought over to Ireland by some early settlers, but such an explanation will not help us much in the case of the other plants. As a matter of fact it seems extremely likely that most of the Lusitanian plants arrived naturally at their present stations by land at the time when the west of England was much nearer to the Continent than it is to-day. The connecting land, now submerged, was ages ago a country enjoying a mild and moist climate. In course of time the plants from Portugal crept steadily northwards until they reached what is now the south-western part of the British Isles. There they remain to-day, although the road by which they travelled has long since disappeared beneath the sea.

The so-called Cornish Heath is found only in the south-west of England and Ireland. It is not seen again anywhere nearer than Spain and Portugal.

The period when the Lusitanian plants became settled in Britain may date back to the epoch before the Glacial Period. It is known that warm conditions then prevailed over the whole of northern Europe, and even into the Arctic Circle. During this period Great Britain formed a continuous part of the continent of Europe. Possibly the Lusitanian flora is a remnant of southern vegetation which journeyed northwards with the increasing warmth. Then came the Ice Age, when all Britain, north of the Thames, was refrigerated. It is supposed that in some sheltered places in the extreme south-west of England and the south of Ireland the plants which form the Lusitanian flora were just able to hold their own. There they remain to-day to tell us of those far-away times when Britain, linked to the Continent, enjoyed a much more genial climate than it does to-day.

Whether this really explains the existence of the Lusitanian flora is not by any means certain. One objection which it is difficult to surmount is the fact that, even if the south of England was not actually refrigerated, it must have been near enough to the ice to have been subjected to a very rigorous climate. Hardly any of the Lusitanian plants will stand much frost, and though no one knows how long seeds may lie dormant while preserving their powers of germination, it is not easy to think that the plants themselves could have survived such conditions as must have been experienced even in the south of England during the Glacial Epoch.

There is just a possibility that the seeds may have been carried on the feet of birds. When, at the end of the Ice Age, the severance of Great Britain from the Continent began, the original Channel may have been very narrow. Most of the Lusitanian flora

have seeds that are small and light such as can be easily transported. This point is worth considering when pondering over the problem of these exiles from the south.

In considering the flora of Great Britain we find very good evidence that the connexion of the island with the Continent is quite recent. Apart from a few insignificant varieties not a single flower occurs in our island which is not also to be found in similar situations in some part of Europe. In ancient islands, such as Madagascar and Mauritius, which have been separated from the mainland for an immense period, this fact is evidence of the great differences which exist between the insular and continental floras. In the processes of evolution the vegetation of the island has diverged from that of the mainland, so that often very distinctive forms of plant life come into existence.

The Pale Butterwort is also a species common in Spain and Portugal and on the sunny shores of the Mediterranean.

Perhaps even stranger than the Lusitanian plants are the three or four species which occur, so far as Europe is concerned, only in the west of Ireland, and do not appear again until North America is reached. The most striking of these plants are an orchid, *Spiranthes Romanzoviana ;* a kind of iris, *Sisyrinchium angustifolium*, and *Eriocaulon, septangulare*. Did this little colony come over the lost continent Atlantis, which tradition tells us once linked Europe with America ? It is perhaps more in accord with known scientific facts to suggest that the plants travelled across the connecting link of land which, in preglacial times, stretched from the north of Scotland to Iceland, from Iceland to Greenland, and thence to America.

Probably the distribution of living forms on this earth will never be fully explained until we know a great deal more about past climates and earth movements than is the case at the present time.

One ingenious explanation, however, hailing from Germany, and substantiated by more evidence than it is possible to include in this article, is the rather staggering theory that the continents were originally clustered together in the southern hemisphere and formed one great sheet of land. With the cooling of the earth's crust this great expanse split, forming seas that are now known to us as the Atlantic and Indian Oceans ; and the continents, floating as it were on some deep half-molten stratum, have in the course of ages been slowly drifting apart, America in a north-westerly direction, Asia to the north-east. The fact that the protuberance of Brazil would fit into the Gulf of Guinea, and that if it did so the mountains of the Cape would make a continuous chain with those of the Plate, and the Atlas Mountains likewise with those of North America, is the most apparent foundation for such a theory. Incidentally, if it were true, it would account for many problems concerning the distribution of plants and animals that have hitherto been considered insoluble, and not least among them, this puzzle of the coming of the Lusitanian flora.

Photo: Stanley Crook.

The Common Lizard (*Lacerta vivipara*) does not exceed six inches in length in the male and seven in the case of the female.

4.—THE MOST ELUSIVE REPTILES: BRITISH LIZARDS

By P. CHALMERS MITCHELL, C.B.E., D.Sc., F.R.S.

VERY few persons, even if they take no special pleasure in natural history, have failed to notice lizards when they have been in France, Italy or Switzerland in summer. But although lizards are quite common in England, Scotland, Wales and Ireland, and often abundant in suitable localities, few persons, except keen naturalists, ever notice them here. There is a good reason for this difference. The lizards we see on the Continent—cannot help seeing, even if we are not very observant—are either the big green lizard or the wall lizard. The green lizard is often over a foot long, vividly coloured, and fond of basking on warm, naked rocks. The wall lizard is much smaller but has the habit of sitting and running about in the full glare of the sun on walls along the road, in gardens or on the sides of houses—any places where flies also like to sit. Although the wall lizard is not very conspicuous in colour, it is so confident that if danger approaches it will be able to escape into a crevice, where it will lie with only the tip of its head visible until the danger is over, that it seems to wait to the last moment before retreating.

The green lizard and the wall lizard have been taken in this country, but there is no reason to suppose that they are true natives, and every reason to believe them strays from some vivarium, as they are the kinds of lizards most often kept in captivity. Our lizards, apart from the legless slowworm, which has already been described, are two in number, the "common" or viviparous lizard, *Lacerta vivipara*, and the sand lizard, *Lacerta agilis*. Both of these are small, the viviparous species not exceeding about six inches in length in the male and seven in the case of the female, the sand lizard being a little larger, seven and a half inches in the male and about eight in the female. Both

take, or seem to take, a good deal of trouble not to be seen, moving off into the undergrowth or slipping into a crevice at the slightest disturbance; and yet they have not many enemies. I once found a hedgehog busy over the remains of a common lizard, but I do not know if it had caught and killed its prey, or was engaged in doing a little scavenging. Hedgehogs certainly catch and kill adders and grass snakes, but I should have thought lizards too quick for them. I do not know of any British birds that take them. Their real enemies are adders and grass snakes, which live on the same kind of ground, are extremely patient and marvellously quick. If they fail to seize a lizard at the first stroke they will pursue it into the undergrowth or into crevices. The green lizard because of its size, and the wall lizard because of the vertical surfaces it affects, are unlikely to be captured by snakes, and so perhaps take less trouble to be inconspicuous in their habits. Our British lizards can escape only by their unobtrusive habits.

Photo: John J. Ward, F.L.S.

The Common Lizard (*Lacerta vivipara*), though it will bask in the sun, prefers places where there is convenient retreat.

And yet, although I do not know what advantage it may be to them, they are combative and plucky little fellows. Their feeble little teeth cannot hurt the human skin, and

Photo: Edward Step, F.L.S.

Wall Lizard (*Lacerta muralis*) with a forked tail, a frequent abnormality produced when the normal tail has been broken off. This species is rather inconspicuous in colour, and has a habit of basking in the full glare of the sun in places where flies like to rest.

Photo. Stanley Crook

A female Viviparous or Common Lizard (*Lacerta vivipara*) photographed on Longridge Fell, near Preston. The eggs are retained until they are ready to hatch.

Photo: John J. Ward, F.E.S.

Common Lizard (*Lacerta vivipara*) watching an injured crane-fly. Lizards are entirely insectivorous.

Photo: Benjamin Hanley.

The Viviparous or Common Lizard is distributed generally throughout the British Isles, and has the distinction of being the only reptile found in Ireland.

they have no venom of any kind. But if cornered they will turn and bite for all they are worth, or stand in a threatening attitude with their mouths wide open. Their big brother, the eyed lizard (*Lacerta ocellata*) of the south of France, Italy, Spain and North Africa, bites as fiercely and as painfully as a large rat. The little wall lizard, just like the English lizards, shows fight, although it can do no damage. Perhaps these small lizards are degenerate descendants of larger and fiercer creatures.

Photo: E. Step.

Sand Lizard.

But let us come back to our British viviparous and sand lizards. The first has the distinction of being the only reptile found in Ireland. It is also to be met in almost every county of England, Scotland and Wales, and throughout the greater part of Northern and Central Europe, but not south of the Alps or Pyrenees, although at least in Europe it seems the hardiest of the lizards and to prefer mountains to lowlands. Probably it was the first to enter the British Isles after the retreat of the ice of the last Glacial Age, when Ireland was still joined to Britain, and Britain to the Continent. Later on, when the more warmth-loving sand lizard arrived, Ireland had already broken off from England by the formation of St. George's Channel. That, no doubt, is a more rational explanation than to suppose that blessed St. Patrick kept other reptiles out of Ireland, but forgot all about the viviparous lizard.

The sand lizard is much rarer and more local than the viviparous lizard, but is fairly common in the southern counties, and has been taken in Lancashire. The two species are difficult to distinguish because each of them is most variable in colour and pattern. Oddly enough, the young soon after their birth or hatching are easy to distinguish; baby viviparous lizards are nearly black all over; baby sand lizards are greyish-brown above and white below. When adult, the viviparous lizard affects a reddish-brown shade above, orange below, and the larger sand lizard is usually glossed with a greenish hue.

Both are spotted, but the spots of the viviparous lizard usually seem to me more irregular, smaller and fainter; those of the sand lizard larger, brighter, and arranged more evenly in longitudinal rows. Both are striped longitudinally; but here again the pattern of the sand lizard is usually better marked. One hot Sunday morning I was talking to a peasant boy near Arles in the south of France about tree-frogs (I really wanted to know if he ever had seen the much-prized sky-blue variety of the green tree-frog), when he produced a flattened grey object which he used as a marker in a little pocket-book. He told me it was a charm against fever. I asked him what it was and

Photo: W. S. Berridge, F.Z.S

The Sand Lizard (*Lacerta agilis*) is fairly common in the southern counties, and has been taken in Lancashire.

if he could get me one. He whipped round to the wall where lizards were sunning themselves, and before I knew what he was about, caught one by the tail as it bolted into a crevice, gave a slight tug, and then offered me the wriggling and bleeding tail, whilst the lizard disappeared. He said that it would soon dry up, and I needn't fear the fevers of the Camargue. Our own lizards, just like the slowworm, have this odd habit of parting with their tails on very little provocation. And a new tail quickly grows, although its scaling is simpler, and the new piece of the backbone is not properly jointed. All sorts of stages in this regeneration of the tail may be found amongst lizards, and examples with a forked tail are quite common, the forking probably being the consequence of an irregular break.

Photo: S. C. Johnson, M.A.

A characteristic watching attitude of a Green Lizard (*Lacerta viridis*) from Jersey showing to advantage the nostril, eye and drum of the ear on one side. Although not native, specimens have been taken in Britain.

Lizards, like all the reptiles, form large eggs with a good deal of yolk, and as a single brood may consist of from six to twelve, the gravid female looks bloated and sluggish. In the common or viviparous lizard the eggs are retained in the body of the mother until they are just ready to hatch or have actually hatched. The tiny black lizards may therefore be produced directly by the

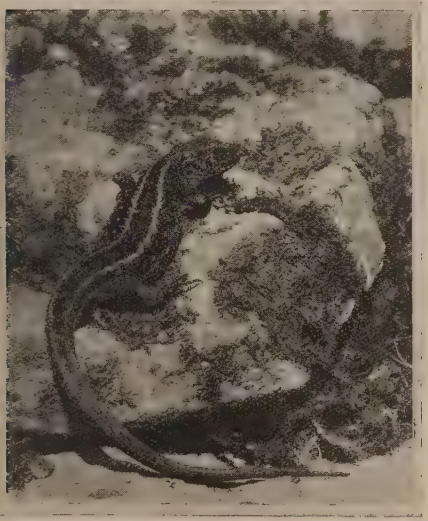


Photo: W. J. Clarke.

The Sand Lizard (*Lacerta agilis*) is very variable in pattern, but the stripes are often more clearly visible than in the common lizard.

Photo: W. S. Berridge, F.Z.S.

The harmless but fearless little Wall Lizards are not true natives of Great Britain, although common in the Channel Islands.

Photo: W. J. Clarke.

Viviparous Lizard (*Lacerta vivipara*) in characteristic attitude.

parent, or may be hatched almost at the actual moment of the soft-shelled eggs being laid. The mother takes no further trouble with them. They are turned loose on the ground and abandoned. They have still a good deal of the remains of the yolk attached to the wall of the digestive canal, and do not require to begin hunting for themselves for several days. But they are able to wriggle about almost at once, and within a week are actively hunting for green-fly and any other small insects.

The sand lizard deposits her eggs, from five to eight in number, in a warm hollow in the sand. The eggs are already in an advanced state of development, and before many days are over the brightly coloured baby lizards break through the firm but papery shell and fend for themselves exactly like the young of the viviparous lizards.

Both the viviparous and the sand lizard prefer places where there is a convenient retreat to tufts of grass, low bushes, furze or heather. They are extraordinarily quick and active, and I do not know any living creatures more difficult to catch. They are about on any warm day from early in spring until late autumn. In winter they lurk under heaps of leaves, in deep pockets of rock, in the recesses of furze bushes—anywhere providing protection from wind, wet and cold. But they are both fairly hardy, and it is not so much cold as the absence of insect food which induces them to lie up in winter.

Both kinds of lizards live almost entirely on insects and spiders. In captivity they will sometimes take small earthworms, but mealworms are their staple food. They should be given access to water, or at least some green leaves, dripping with moisture, should be put in their cages every day. But it seems a shame to keep in vivaria creatures which are essentially active open-air lovers of freedom. Nor is anything to be gained except gratification of the sense of possession, because I have never known them to become really tame.

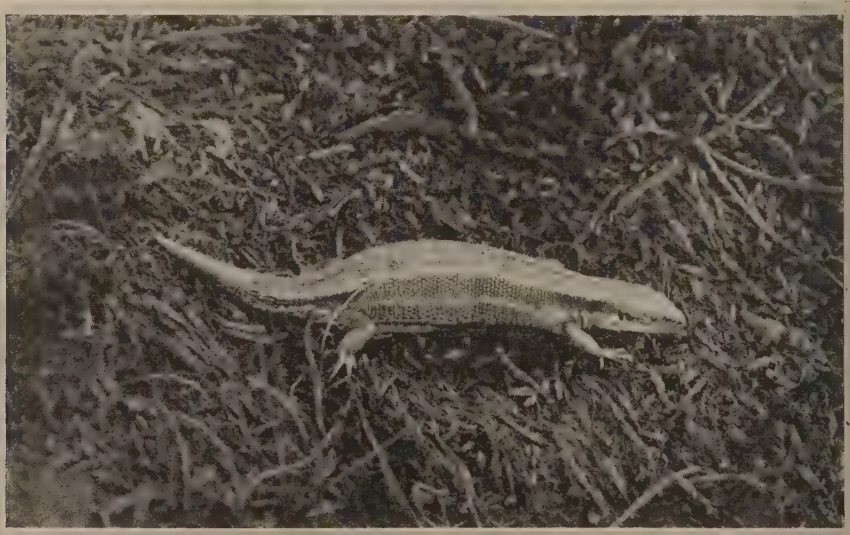


Photo: T. M. Blackman.

The tail of the Lizard is very brittle, and is liable to break off if seized; but it will grow again, in the manner shown in this photograph.

Photo: George Hearn.

On the top of the cliffs the ground was rough and broken up by rabbit holes. Often the children would see the little white tails disappearing as they came round a corner, and sometimes the young ones, who had not yet learnt how dangerous human beings can be, would sit and look at them quite a long while before they, too, ran off to their holes.

XI.—Who was in the Cave?

"WHAT a hullabaloo! What can it be?"

The children were away on an expedition along the coast. They had just come over the hill, and were making for a little cove that they had never seen before, when this extraordinary booing and wailing fell upon their ears.

"What *can* it be?" repeated Topsy.

The sound, like someone moaning and sobbing, came up from the sea and echoed uncannily among the rocks.

"It must be somebody hurt!" said Popsi. "I expect they have fallen over the cliffs and broken their legs."

"We must go and help them!" said Boodles at once.

Down the slopes the three of them ran, eager to find out what was the matter.

But, alas! at that particular point it was not so easy to get down. The bracken-covered slope ended in a sheer cliff.

The children looked down. By the thunder of the sea beating always against it, the cliff below was broken up into pinnacles and archways and caves. Gulls were swooping about, and on one shelf where the sea ran up into a great crevice, a little family of big-nosed puffins were sitting, looking like some quaint sort of sea parrot. But there was no way down.

"We can't go that way," said Topsy. "We must go out to the point; it's quite easy over there."

They went on, and still the moaning echoed up from the

rocks at the root of the cliff. On the left side of the cove the point ran far out to sea, and the ground sloped gently down to it. Here and there it was broken up by rabbit burrows, and often, as the children came round a hump, they would see the little brown forms scampering away with a flash of white tails. Once they came, all of a sudden, upon a young bunny, sitting as sedately in the sunshine as if three chattering children were miles away. Only for a moment, however, then it, too, turned tail and vanished into the nearest hole.

Photo: R. Kearton, F.Z.S.

Was it a dog, or a merman—the strange smooth-haired creature that was swimming in the sea below?

Suddenly there was a cry from Popsi.

"Oh," she cried, pointing down to the sea. "Oh, look! There is a poor little dog! He can't get out—he's drowning! I must go and help him!" And away she ran down the hill.

Topsy and Boodles came to the edge and looked down to the clear green water below. Certainly there was some queer animal swimming there. It had a smooth round head and a tapering body, and it was paddling to and fro in the water like a dog. Then without a sound it sank and disappeared.

"Oh!" cried Boodles in dismay. "It is drowned!"

"It wasn't a dog," said Topsy. "It had a fishy sort of tail. And I don't believe it was drowning either! Let's come on down, we mustn't lose sight of Popsi."

They scrambled down to the beach, and there was Popsi gazing out to sea, trying to make out where the animal had disappeared.

Then suddenly up bobbed a head—a smooth, shiny, dark-haired head.

The children gasped.

"It's a man!" cried Popsi.

But as she spoke the head went under water again, and then away on the right, from under the cliffs, again came the moaning and wailing.

The children began to feel rather creepy now, the noise sounded so close.

"It can't be a man!" said Topsy, "unless it is a merman."

"But, anyway, let's find out what all that noise is!"

Cautiously they crept along the rocks by the edge of the sea. There was no sandy beach in this cove, the rock cliffs went straight into the sea with a series of shelves that just allowed one to pass along. Very carefully and quietly they made their way towards the

Photo: J. D. Rattar.

THE GREAT CREVICE THAT LED TO THE CAVE.

By the thunder of the sea beating always against it, the cliff below them was broken up into pinnacles and archways and caves.

place which they now saw was the opening into a cave. Just before it was a sunny shelf of rock. Quietly they climbed up over the edge.

There on the rock, basking in the sun and fast asleep, was a long brown animal with a smooth round head, flippers for legs, and a fishy tail.

It was a seal!

Boodles could not keep back a shout of wonder. At the sound the seal woke up, gave them a glance of surprise, bundled quickly over the rock and slipped into the water.

At the same moment other splashes were heard in the cave and several dark forms, the length of a man, swam out to sea. It was a nursery of the seals! Every summer the mother seals come to the rocky caves, and here they bring up their babies, teaching them to swim and hunt for fish. But the father seals stay out to sea, fishing in deep waters till the children are big enough to come out and join them.

So though they were disappointed in finding no one to rescue, the children were quite pleased with their adventure, for they had found something that none of them had ever seen before.

"And I'm rather glad after all that no one had broken their legs!" said Popsi as they climbed the hill once more and set out for home.

Photo: R. Kearton F.Z.S.

Sunning himself on a ledge of rock and half asleep was a young seal.

NEWLY EMERGED DRAGON FLY AND EMPTY NYMPHAL SKINS

From a Colour Transparency by Reginald A. Malby, F.R.H.S.

23.—THE LIFE STORY OF A DRAGON FLY

By RAY PALMER, F.E.S.

THE insect world is full of wonders and contains numerous mysteries which are but little understood. Among the aquatic insects especially, we find wonderful methods of adaptation to environ-

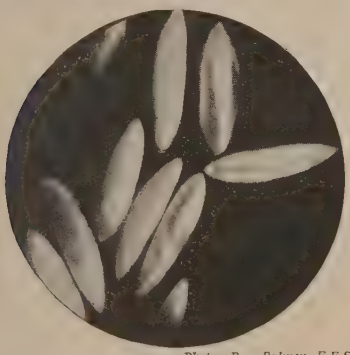


Photo: Ray Palmer, F.E.S.

Dragon Fly's eggs are pale yellow in colour and about one-sixteenth of an inch in length. (*Highly magnified.*)

ment and many very marvellous life histories; but while most of these insects are comparatively small and insignificant, some of the commonest dragon flies have both large size and striking appearance to add to the remarkable and spectacular nature of their metamorphoses.

The larger dragon flies are among the few insects that occasionally force themselves on the attention of even the most unobservant people, and their formidable appearance makes them objects of terror to the ignorant. Country folk call them "horse stingers," but such a name is entirely without foundation, as they possess no sting and are perfectly harmless.

We have about forty British species, but only a comparative few are common; these few, however, include a number of large and brilliantly coloured insects, which are exceedingly powerful fliers; in fact, with the exception of some of the hawk moths, the dragon flies include the largest insects we have in this country.

The largest British dragon fly (*Anax imperator*) is about four inches across the wings, and the species depicted here (*Æschna cyanea*) only slightly less.

The dragon fly in its perfect state is familiar to everyone, but its form and habits in its earlier stages are comparatively little known.

Let us, therefore, trace the life history of one of the commonest species from the beginning.

A large weedy pond or lake, with the margins fringed with rushes, is a favourite

Photo: Ray Palmer, F.E.S.

The Dragon Fly lives for two years or more in the larval state, when it feeds voraciously, chiefly upon young insect-larvæ smaller than itself.

haunt of these magnificent insects. A hot day in late summer is the best time for observing them, and if a sharp look-out be kept, the process of egg-laying may sometimes be watched.

The eggs are deposited in different ways according to the species. Some simply drop their eggs into the water as they fly over the surface, others do the same while at rest, and a few possess ovipositors with which they insert their eggs in the stems of aquatic plants. This last group includes the species dealt with here.

The eggs are about a sixteenth of an inch long, and yellowish in colour. Their shape may be seen from the first photograph on page 865.

The newly-hatched larvæ are, of course, very minute; but they are seldom found at this stage. The smallest larva of this species the writer has ever come across was a little over a quarter of an inch in length, and must have been at least several weeks old.

The colouring of the larva greatly resembles the mud of the pond in which the little creature hides when young. Lying concealed and motionless, it is invisible alike to its enemies (the larger inhabitants of the pond, which would prey upon it) and also to the smaller creatures upon which it feeds.

Photo: Ray Palmer, F.E.S.

In addition to the ordinary jaws or mandibles, the Dragon Fly larva possesses a second pair attached to a jointed organ which folds away under the thorax.

At a very early age its food probably consists of small animalcules and young insect larvæ smaller than itself; it feeds voraciously and rapidly increases in size if food be plentiful. As it grows it attacks larger and larger creatures, until, when full grown, it is a match for any of the smaller denizens of the pond.

The illustrations give a better idea of the appearance of the larva than any description.

One of the most remarkable things about the dragon fly larva is the way it catches its prey. This may be easily observed in an aquarium. Watch a larva as it lies motionless at the bottom or amongst the water plants. Presently some unsuspecting creature passes within half an inch of its head. The larva itself remains stationary, but there is a movement of the head, so sudden and rapid that the eye can scarcely follow it, and the next instant we see the unfortunate insect, tadpole, or whatever it may be, held tightly in a pair of pincer-like jaws and being greedily devoured.

The explanation is that in addition to the ordinary jaws, or mandibles, by which it feeds, the larva possesses a second pair attached to a jointed organ which folds away under the thorax, between the legs. This arm-like organ can be extended suddenly at will, the jaws on the end of it seizing the prey and conveying it to the mouth. This extraordinary appendage is a specialization of the *labium*, or lower lip. The real mouth and the lower part of the head are completely concealed by it, and it is, therefore, called the "mask."

The dragon fly larva is very lethargic, lying in wait for its unsuspecting prey, and seldom going on the chase, though if short of food when kept in captivity it will follow, and snap at, almost any moving object.

After several moults the wing sheaths begin to appear on the thorax, and the insect has then arrived at the next stage of its existence. Its activity now increases to some extent, and it gradually spends less and less time wallowing in the mud, but wanders about over the water plants and occasionally swims, when necessary. Its method of swimming is very interesting, and, curiously enough, is also connected with respiration. Unlike many aquatic larvæ, it does not have to come to the surface to breathe, but obtains its air supply from the water. If the tail end of the larva be examined, it will be seen that it terminates in five short spines, three being considerably larger than the other two. Each of these spines protects a small aperture, and they can be closed together to a point or spread apart. The respiration is conducted by sucking water into the abdomen through the five openings at its extremity; the air is partially extracted by a complicated tracheal system inside, and the water ejected. This goes on all the time very gently, but if the larva wishes to swim, it is done much more rapidly and the water expelled forcibly, so as to propel the body forward.

The aquatic life of the larger dragon flies lasts from two to three years, the period depending largely on the food supply.

When young they are called larvæ, until they show rudimentary wings, after which

Photo: Ray Palmer, F.E.S.

The "mask" of the Dragon Fly larva can be extended suddenly at will, the jaws at the end of it seizing the prey and conveying it to the mouth. (× 2.)

they are termed nymphs. There is no dormant state corresponding to the pupa of moths and other insects; the creature is active and feeds throughout its entire existence, and varies in form but little during its aquatic life.

The change in the respiratory organs which converts a water-breathing animal into one breathing atmospheric air is not so sudden as is generally imagined. The aerial breathing system of the dragon fly is gradually formed under the skin of the nymph; but for a long time the spiracles, or breathing pores, are closed, and the nymph continues to breathe water in the usual way.

On nearing maturity, however, the spiracles become partly opened, particularly those communicating with the four large tracheal tubes of the thorax. The insect is, therefore, enabled to breathe atmospheric air, in addition to its aquatic method of respiration. This is apparent from the fact that it shows a greater liking for the surface of the water, and frequently comes right out, or only partly out. In the latter case the nymph can, and probably does, employ both methods of respiration at the same time.

Whether or not the aquatic method of respiration becomes less efficient as the time for emergence approaches, it is difficult to say; it probably does, for nymphs kept under observation in captivity resorted to the aerial method with increasing frequency as the time for their emergence drew near.

It is possible to tell, by looking at the eyes of the nymph, when it is nearly ready to emerge. A few hours before emergence the eyes assume a brilliant and transparent appearance; this is supposed to be due to the pressure against the outer skin of the eyes of the perfect insect, which have already acquired much of their full brilliancy.

The wonderful process of emergence will best be followed by tracing the development of the insect from which these photographs were taken.

At 12.30 p.m. the nymph was resting in a similar position to that shown on page 868. A few minutes later it began to move slowly upwards, climbing the dead flower-stem of a water plantain. A few inches out of the water it rested awhile, until its body had become dry. Fig. 1 (p. 869), taken at 12.50, shows it in this position. Then it suddenly

Photo: Ray Palmer, F.E.S.

When the larva develops rudimentary wings it is termed a Nymph, in which state it continues an active aquatic existence.

seems possessed of unusual energy, and climbs rapidly higher and higher, searching for a convenient situation to undergo its metamorphosis.

Having found a suitable place on the stem where there is plenty of room and a firm hold is obtainable, the nymph rests from its exertions, and shows but little sign of life ; indeed, on more than one occasion we have found nymphs at this stage and thought they were dead, for they made no responsive movement when they were touched.

During this first resting period the nymphal skin no doubt becomes separated from that of the dragon fly within, and

Photo : Ray Palmer, F.E.S.

When approaching maturity the Nymph develops spiracles or breathing pores which enable it to breathe atmospheric air. This photograph shows one leaving the water to undergo its transformation into the Dragon Fly.

is probably insensible to touch. It is also noticeable that the eyes assume their previous dull tint.

After resting thus for a short time, the insect appears to exert some internal muscular force. The result is that the skin splits in front of the wing-cases and reveals the pale coloured thorax of the dragon fly within. Fig. 2 (taken at 1.5 p.m.) shows this opening clearly.

Two minutes later (Fig. 3) the slit has become greatly enlarged, and has extended to the top of the head, at the same time forming lateral slits above the eyes. Fig. 4 shows the head being withdrawn through this newly-formed aperture. With the freeing of the head the emergence proceeds rapidly for a few minutes. The insect bends back its head and thorax so as to extract the legs, the nymphal claws still retaining their hold on the stem, although they are but empty sheaths.

The linings of the four large tracheal tubes remain attached to the old skin and the bending backwards of the fly causes them to be withdrawn from the thoracic spiracles. They are observable as two white strands stretching from each side of the thorax, and are plainly visible in Figs. 5 and 6.

At this stage the efforts of the insect to free itself are very apparent ; it is seen to be straining backwards with all its might. As the third pair of legs come away, it bends so far backwards that it hangs head downwards, at the same time completely withdrawing the white threads from the spiracles. Fig. 7 shows when it first assumed this position.

When the legs are entirely freed, only the end of the body remains within the case, and by this the insect is supported. The body is now swayed about gently, and the legs worked up and down as if to exercise them. Then in three or four minutes the legs are folded up to the body and the dragon fly rests quietly.

In the present case this resting stage lasted twenty-two minutes, but I have known it vary from fifteen minutes to half an hour. During this period the preparation takes place for the coming gymnastic feat, for which it is essential that the claws and legs be strong and hardened, and the body possessed of the required energy.

Towards the end of this stage it is necessary to watch the insect closely, so as not to miss the reversing action, which takes but an instant to accomplish. Suddenly the insect arches its body upwards and clasps its old skin. For a fraction of a second it is in a loop formation, as seen in Fig. 11, then the abdomen is drawn from the case and straightened out.

The minute size of the wings can be seen from Fig. 12. The following photograph, taken only four minutes later, shows how the wings begin to develop immediately the position is reversed. The growth of the wings is no doubt due to the injection of fluid into them along the veins, and takes place with extraordinary rapidity. (*See*

1 12.50 p.m. | 2 1.5 p.m. | 3 1.7 p.m. | 4 1.9 p.m. to 1.12 p.m. | 5 | 6 | 7 Emergence of the head and legs.

8 1.15 p.m. to 1.17 p.m. Exercising the legs | 9 | 10 Twenty-two minutes rest. | 11 1.42 p.m. A final effort | 12 1.46 p.m. All clear. | 13 Four minutes later. | 14 1.53 p.m. The wings developing.

15 1.57 p.m. | 16 2 p.m. | 17 2.35 p.m. Development of wings. | 18 2.50 p.m. Abdomen developed. | 19 4 p.m. The wings dried and ready for flight. | 20 The empty nymphal skin.

Photos: Ray Palmer, F.E.S

THE FINAL PROCESS OF TRANSFORMATION OF THE DRAGON FLY.

Figs. 12 to 17.) They are limp and wet, and of an opaque yellowish colour, while the body at this stage is pale green all over. The wings had attained their full size in thirty-three minutes, but were still limp and opaque. The abdomen then began to develop, and became longer and thinner, accompanied by the discharge of a quantity of fluid. Fig. 18, taken at 2.50 p.m., shows the abdomen fully developed, but the wings, though gradually becoming transparent, are still closed up over the back, in a position never assumed by these dragon flies once their wings are dry.

The actual development now being accomplished, drying is all that is required, but this takes at least an hour to complete.

The emergence began about 1 p.m., and the wings were not spread out into the normal attitude until 4 p.m., so the change takes three hours to accomplish. Even then the insect lacks all the brilliant colouring, which appears later, and its wings, though transparent, have a glazed or "glassy" appearance.

Photo: A. Harold Bastin.

What a Dragon Fly looks like when about to seize its prey. (*Greatly enlarged.*)

Dragon flies at this stage are spoken of by entomologists as "immature," and are never used as specimens. The full colouring does not appear until they have been several days, or even weeks, on the wing, and gradually darkens with age.

Having taken these photographs, and watched this magnificent insect through all its transformations, I then had the pleasure of seeing it spread its wings and take its first flight in its new-found element.

The nymphal skin, which the dragon fly has left behind, is now worth attention. So perfect is it that it might be taken for a living insect, if the hole in the thorax were not noticed. Through this hole the linings of the tracheal tubes are seen protruding (*see* frontispiece). The wing-cases are turned back, as left when the wings were drawn out of them; the claws still retain their grip, and even the covering of the eyes remains.

Perfect indeed it is, but only a shell, from which the being that animated it has escaped, to enjoy a higher and larger life in the world of air and sunshine.

Photo: J. J. Ward, F.E.S.

The gay-coloured Burnet Moths are not found everywhere, but in places that they favour may be seen in great numbers, sometimes a dozen or so upon one grass stem.

24.—BURNET MOTHS

By A. HAROLD BASTIN

THE gaily-coloured moths called "burnets" are not found everywhere; but in the localities which they favour—usually chalky or sandy uplands, both inland and within sound of the sea—they frequently occur in such numbers that one may often count as many as eight or a dozen individuals sunning themselves upon one thistle or scabious bloom. How these insects came by their popular name is not certainly known; but Mr. Edward Step has made the ingenious suggestion that it may, perhaps, have been bestowed upon them by some early insect hunter in the mistaken belief that the caterpillars eat salad burnet; and, further, that this unknown gentleman confused the plant which rightly bears this name with another—the dropwort. These two plants, the salad burnet (*Poterium sanguisorba*) and the dropwort (*Spiræa filipendula*), grow in similar situations, especially on chalk and limestone soil—where, too, the common six-spot burnet moth is likely to be found. Now, if our hypothetical entomologist believed that the caterpillars of this moth fed on salad burnet, but failed (as he might easily do) to distinguish between this plant and the dropwort, he might take specimens of the latter to a botanical friend for identification; and so, in the end, come to regard the scientific name of the salad burnet as *Spiræa filipendula*—and christen his moth "*filipendulæ*," thus connecting it with the burnet.

In general, our British burnet moths may be described as having the body deep green or indigo, the fore-wings deep shining green with crimson spots, and the

hind-wings crimson with a green border or margin. The " feelers," or antennæ, are about three-quarters the length of the fore-wings, and are considerably thickened towards the apex, but taper finally to a point. The insects fly by day, rather slowly and heavily, and unlike the more typical moths appear to revel in the hottest and brightest sunlight. They have long proboscides, and frequent many kinds of flowers, from which they suck the nectar —thistles and other compositæ being their especial favourites.

The tiny yellowish eggs are long-oval in shape, finely ribbed or reticulated. They are laid by the females on low-growing herbage in late summer—the chief food plant of the six-spot burnet being the common bird's-foot trefoil (*Lotus corniculatus*). The young caterpillars may be found in August, and occasionally in late July. They pass through the winter in the larval state, and complete their growth in the following May, when they climb up tall grass stems and spin their cocoons, wherein they are eventually transformed into black, shining pupæ, which have considerable powers of movement. The cocoon is a long spindle-shaped object, pale yellowish or ochreous in colour, with a smooth, glazed outer surface. It is made of silk, very tough and closely woven, and forms an ideal protective envelope, the more so as it is not very easily distinguished from the flower-heads of the grasses by which it is surrounded on all sides.

(*a*) (*b*) (*c*)

Photo: Hugh Main, B.Sc., F.E.S.

(*a*) When its growth is completed, the Burnet Moth Caterpillar climbs up a grass stem, and prepares to spin its cocoon. (*b*) The cocoon in half-finished state. (*c*) If the finished cocoon be opened it will sometimes be found to contain an ichneumon grub instead of the Burnet Moth Caterpillar. The Ichneumon Fly will have laid its egg in the body of the living caterpillar, and the grub, when it hatches, proceeds to feed upon its host.

When the time for the emergence of the perfect insect approaches, the black pupa wriggles its " head and shoulders " out of the upper end of the cocoon ; and there the empty skin remains long after the moth has dried its wings and flown away.

The caterpillars of all our British burnet moths are short and stout, dull or dark green in colour, spotted along the back and sides with black and yellow. Several of the species resemble each other so closely that it is difficult—sometimes impossible —to tell them apart. The same may also be said of the perfect insects ; for, as Mr. Edward Meyrick remarks, " they are very similar, often interbreed, and are particu-

larly liable to form local races; so that their study is extremely difficult." For practical purposes, however, the following list will enable the novice to distinguish between our six native species.

The Six-spot Burnet (*Zygæna filipendulæ*). Normally, with six crimson spots in the fore-wing, which, however, occasionally unite to form a red blotch, while in some specimens the lower spot of the outer pair is small and inconspicuous. There is a variety (*lutescens*) in which the spots and hind-wings are yellow, instead of crimson. This is the commonest species.

The Five-spot Burnet (*Z. loniceræ*). With five crimson spots in the fore-wing. The two spots towards the middle of the wing area are especially characteristic, the upper one being small and rounded, the lower large. These two spots rarely unite, and blotched varieties of the species are exceedingly rare, although they are common among the closely allied *Z. trifolii*. Still more rare are varieties with yellow spots and hind-wings. This species is more local than the "six-spot," but abundant where it occurs.

The Broad-bordered Five-spot Burnet (*Z. trifolii*). This species gets its popular name because the dark green border of the hind-wing is usually slightly broader than in *Z. loniceræ*. A more reliable character, however, is supplied by the spots in the middle of the fore-wing, which are larger than in the preceding species, closer together, and not infrequently joined to form one spot. In a common form of this species the basal spots are also united; while a variety (called *confluens*) in which all the five spots run together, thus appearing as a longitudinal blotch, is by no means rare. The variety with yellow spots and hind-wings is not so unusual as in *Z. loniceræ*. In fact, this is the most variable of our burnets, and some individuals are very difficult to separate from the last species; while in some localities numerous specimens with six spots in the fore-wing are found. The range of *Z. trifolii* extends farther northward than that of *Z. loniceræ*.

The New Forest Burnet (*Z. meliloti*). This species is not unlike a small example of the preceding, but the fore-wings have a greyer sheen, while all the wings are less thickly scaled. Occasionally a sixth spot appears in the fore-wing, indicated obscurely. As its popular name suggests, this insect is almost confined, in Britain, to certain localities in the New Forest, in Hampshire, where it is abundant.

Photo: Hugh Main, B.Sc., F.E.S.

The cocoon of the Burnet Moth is a spindle-shaped object, ochreous yellow, and is therefore not easily distinguished from the flower-heads of grasses by which it is surrounded.

The Alpine Burnet (*Z. exulans*). This is the first of the two species of burnets whose wings are very thinly scaled, so that the insects have a "rubbed" and faded appearance. There are five crimson spots in the fore-wing, while the abdomen is clothed with rough, black hairs. The females are easily distinguished from the

Photo: Hugh Main, B.Sc., F.E.S.

When the time for the emergence of the moth approaches, the pupa wriggles its head and shoulders out of the upper end of the cocoon—

other sex, since they have whitish, or pale yellow, patches on the thorax. This is the common mountain burnet of Northern and Central Europe. In Britain it is confined to certain localities, above 2,000 feet, in Scotland.

The Blotched Burnet (*Z. pilosellæ* or *minos*). This, the second thinly scaled species, has three elongated crimson blotches in each fore-wing. It is very local, but usually abounds where it occurs—e.g. in Galway, on the west coast of Great Britain, on the Cornish coast, etc. Specimens from the coast of Carnarvon (Abersoch) are exceptionally dark.

The caterpillars of the first four of our British burnets feed on bird's-foot trefoil, meadow vetchling, and clovers; those of the Alpine burnet on moss campion (*Silene acaulis*) and lady's mantle (*Alchemilla alpina*) as well as clovers; and those of the blotched burnet on thyme.

Burnet moths illustrate very well the theories of "warning coloration" and "convergent mimicry." They belong to a natural group, or family, of showily coloured moths which are rarely eaten by insectivorous creatures, even if they are attacked and killed, because the juices of their bodies are strong-smelling and unpalatable. Now the theory of "warning coloration" postulates that the showy liveries of these moths are definitely correlated with their inedible qualities, and act as danger signals to birds, reptiles, etc., thus warding off their attacks. It is certainly true, as we have seen, that burnet moths fly slowly in full sunlight, and are at no pains to conceal themselves, but rather the reverse; yet they are apparently free from molestation. We must remember, however, that if the theory of "warning coloration" is true, the immunity from attack must be relative—not absolute. Young birds, etc., have to find out by experience that warningly coloured insects

Photo: Hugh Main B.Sc., F.E.S.

—and there the empty skin remains long after the insect has dried its wings and flown away.

Photo: Benjamin Hanley.

The Six-spot Burnet Moth normally has six crimson spots in the fore-wing. These sometimes unite to form a red blotch, while in other forms of the species the lower spot is small.

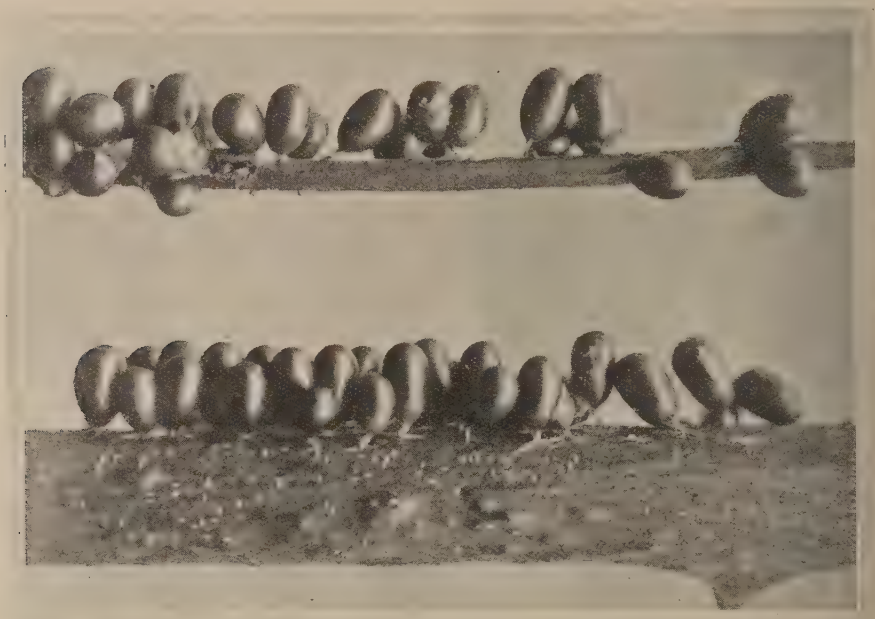
are not "good to eat"; and in learning this lesson they are likely to maim or destroy a limited number of victims. Nevertheless, while some *individuals* will thus suffer, the net result to the *species* with a distinctive, warning livery must be highly beneficial as a "life-saving" device.

This theory of "warning coloration" was suggested by Wallace, Darwin's great fellow-worker, in explanation of the brilliant and conspicuous colours and striking patterns of many insects which, notwithstanding their attractiveness, seem little subject to attack by insect-eating creatures. Subsequently, another naturalist, Fritz Müller, pointed out that if the theory were true in regard to a single species, it should also be found to "work" between two or more similarly coloured species in a given district. Investigation has shown that pairs, and groups, of warningly coloured species do, in fact, exist in many parts of the world. Sometimes, but by no means invariably, the species are closely related—as is the case with our burnet moths; but whether a close "blood" relationship exists or not, both, or all, the species *look* similar because they "converge" towards one and the same type of conspicuous coloration.

If the theory of "warning coloration" is a true theory—and most naturalists today are willing to concede this point—then *all* the species in a given "combine" or "convergence" must reap a benefit over and above that which would accrue to them as isolated species, no matter how conspicuous and effective their warning liveries might be; moreover, the rarer of two species in a "combine" will gain most. This was brought out strikingly by Müller in his original explanation of his theory of "convergent mimicry." If the relative numbers of the two species are as 1 to 5, the relative advantage from their resemblance is as 25 to 1.

Photo: G. C. S. Ingram.

The Five-spot Burnet Moth has five crimson spots in the fore-wing; of the two spots towards the middle of the wing, one is small and rounded, the lower large.



When the time comes for the Slime Fungus to bear fruit, it seeks drier quarters, and the whole mass is converted into round vessels containing spores. These when mature ultimately float away on the breeze.

2.—PLANT OR ANIMAL?

By S. LEONARD BASTIN

With photographs by the Author

APART from some of the minute forms of life it would seem to be easy to distinguish a plant from an animal at a glance. Yet, in one strange group, science has not decided to which of the living kingdoms the organisms belong. The types known as *myxomycetes*, or slime fungi, appear to lie right on the borderland between the animal and the vegetable worlds. These remarkable beings have caused an immense amount of perplexity on account of the fact that, in some ways, they behave like plants but, in other and more important directions, they display attributes associated with animal life. In some museums preserved specimens of the myxomycetes are placed in the animal section, whilst in other institutions the slime fungi are put with the collection of plants. Modern opinion inclines to the belief that the slime fungus is really an animal, although to the casual observer it has no resemblance to one.

One of the commonest of the British slime fungi (*Badhamia utricularis*) is quite abundant in some years. It is seen on rotting bark or wood, and takes the form of masses of a gelatinous substance which is

of a very bright chrome-yellow. In fact, the colour of this slime fungus could hardly fail to attract attention, although most people would not realize the peculiar interest of the organism. The gelatinous mass (*plasmodium*) is practically naked protoplasm, and such a large aggregation of living matter in this simple state is quite unknown in any other form.

Although the slime fungus appears to be an inert body, there is a great deal going on in this mass of yellow stuff. The whole of the organism is continually on the move, and this movement is of two kinds. First, there may be an advance of the mass as a whole, and, secondly, there is an internal circulation of the protoplasm.

The movements in the myxomycetes do not go on in any chance fashion, and they are pursued according to the needs of the organism. Thus a plasmodium in an active state will move towards the damper side of a piece of rotting wood, pouring over it with a slow, but none the less sure, movement. At the same time the internal movement in the mass becomes very vigorous. The flow in the veins is rhythmical, that is, the current goes steadily in one direction for about two minutes, and after a pause starts to travel in the opposite direction. The internal flow of current lasts longest, however, in the direction in which the main body of the plasmodium is advancing. As a rule the slime fungus tends to avoid light in its plasmodium stage, and seeks out the dark.

How the Slime Fungus Feeds

One of the most remarkable things about the myxomycete is the way in which it feeds. Practically all the slime fungi live on rotting wood or certain kinds of true fungi. Now, if a piece of suitable food material is placed near to a slime fungus, the mass of living matter rapidly moves towards it. In quite a short while the plasmodium will have overwhelmed the morsel. When the food has been enclosed, the process of digestion starts, and the waste material which the slime fungus does not require is left behind. This method of taking up solid food is similar to that found amongst animals, and is unknown in the plant world.

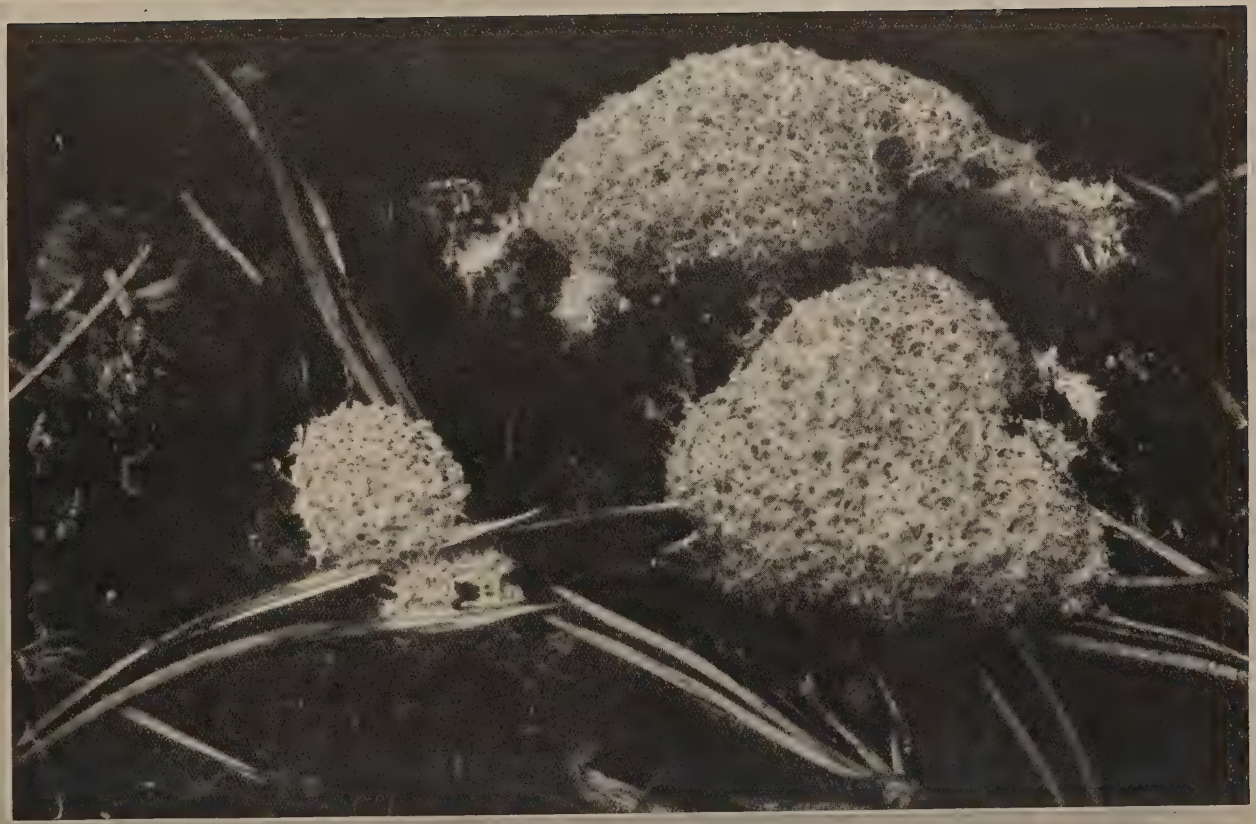
Now and again the plasmodium of a slime fungus will pass into a resting state. This is frequently the case in times of drought, although not always so. In this stage the plasmodium becomes hardened and is divided up into a number of cysts or cells. In its resting phase the plasmodium is known as the *sclerotium*, and it may remain in such a condition for as long as three years. When well moistened a plasmodium in this state will revive and once more begin the movements associated with its active life.

How the Spores are Formed

Sooner or later in the life of the slime fungus there will come a time when it begins to fructify. Then the mass of protoplasm undergoes a great change and the whole of it is converted into numerous sporangia containing spores. A typical *sporangium* is a rounded hollow case borne on a stalk. Within the case there are numerous threads forming a network, and in this the spores are produced. Just as the plasmodium was suggestive of an animal, the manner of the spore formation is similar, in many ways, to that found amongst plants.

When the slime fungus is about to change into what may be called its vegetable state, it seeks out drier quarters. For their wide dispersal it is desirable that the spores should be in a dry state so that they may float away on the breeze. When the spores finally alight on some moist surface such as might be presented by rotten wood or decaying leaves, they begin to germinate. From each there creeps out a mass of living jelly, called a " swarm cell," somewhat resembling the low form of life known as an amœba. The form of this speck of life is continually changing. Soon a lash-like extension is developed at one end, and this exhibits a good deal of activity. When the lash comes into contact with any bacteria that may be engaged in breaking up dead wood it will embrace them, and the mass of living matter flows over the food and digests it. Here again we have the taking in of food in a solid state which is quite unlike the behaviour of any true plants.

The swarm cells multiply repeatedly by division into twos, and from numbers of these cells the plasmodium is built up and a new slime fungus appears on the scene. Thus the life cycle of what is surely one of the strangest organisms in the world is completed.



A BORDER-LINE ORGANISM.

Admittedly neither animal nor plant within the definitions of the scientist. A Slime Fungus in its active state of existence.

As a breeder the Snipe is not a very gregarious bird; he prefers to keep his affairs to himself and not to be in too close contact with others of his species.

43.—TWO WADERS: THE SNIPE AND SANDPIPER

By HENRY WILLFORD

With photographs by the Author

FROM the extreme north to the farthest south of the British Isles, in any kind of marshy and undrained land we may expect to find the common snipe. In spite of this, those that breed in this country are but few compared with the vast number of birds that arrive from Scandinavia during the winter months, and depart again towards the end of March to breed elsewhere.

Most of us who at one time or another have roamed over the countryside must know the alarm note of the snipe. With a sharp *scape*, *scape* he rises from the ground, flying rapidly in a zigzag till he is well out of harm's way. Up he goes soaring into the sky until he is lost in space. Then, if the eye can follow him, he may be seen to circle at a great height and return like a boomerang, descending rapidly, often not far from where he was flushed. At other times, when cover in the form of reed beds is at hand, he may go but a short distance, and can be flushed a second time. During the

In the incubation period the Snipe is a very close sitter, and will allow one to come quite near before taking flight.

winter months when "Jack Frost" has gripped their usual feeding grounds in his iron grasp, snipe may often be found in the root fields or even on sheltered fallow land. They feed largely on worms and insects, which they secure by probing their long beaks into the soft ground, and they seem to have a partiality for certain feeding grounds. In one place in the south of England in a wet meadow adjoining the high road and practically in the centre of a small village, I can be fairly certain of flushing several snipe any day during the winter months, yet other grounds of a similar nature close by seem never to tempt them. No doubt this particular meadow contains something edible which it is easier to obtain there than from the adjoining land.

As a breeder the snipe is not a very gregarious bird, preferring to keep his affairs to himself and not to be in too close contact with others of his species.

The nest is situated among coarse grass or heather, and is fairly deep, lined with dried bents and grasses. Four pear-shaped eggs are laid, extremely large for the size of the bird. One nest I found in the New Forest district in 1922 contained five eggs, which is, I believe, a most unusual number, for the adults would have some little trouble in incubating so large a clutch.

In ground colour the eggs vary from a yellowish to a greenish olive, spotted and blotched with brown and black. The easiest way to find them is undoubtedly to endeavour to flush the sitting hen, otherwise it is like looking for the proverbial needle in a haystack.

A Snipe makes a very cautious approach to her nest, creeping through the grasses, crouching very low, and parting the stems with her long beak, as if to make sure that no enemy is near.

The incubation period, I have found, varies from fifteen to seventeen days, and during this time the hen and perhaps the male—for the sexes are extremely difficult to distinguish—sit very close, allowing one sometimes to walk within a foot of them without taking flight.

anticipated some difficulty in photographing them. I had been waiting in my "hide" some short time, not expecting them to put in an appearance for a long while. Proceeding to fill my pipe, I was just about to strike a match when I chanced to look at the focusing screen of my camera,

The Sandpiper, or Summer Snipe, is another member of the graceful family of waders which may be seen on the shores of our lakes and rivers.

It is most interesting to watch at close quarters the snipe coming to her eggs or newly-hatched young. She will creep along through the grasses by devious ways, crouching very low, and parting the stems with her long beak, occasionally stopping to listen, and then again cautiously proceeding. In this way the birds appear to tread down a sort of tunnel, or sometimes two, which they invariably use when approaching the nest. The first pair I had under observation caused me some little surprise, as I had and to my surprise there sat the snipe, cosily settled on her eggs as comfortable as could be. The cunning little bird had crept noiselessly through the grass to her nest unobserved, in spite of the fact that only a few minutes before I had flushed her off, and she had soared away into space as if never to return.

It is the unexpected that often happens while bird watching, and it is just this and the fact that one seldom meets two birds, even of the same species, exactly alike in

temperament, that makes it a sport as well as a pastime. Often when near the nest both birds would utter a rapid and off-repeated call which sounded like *tyik, tynk*. When the first young appeared the male was constantly at hand, usually at the back of the nest with his beak over his mate's shoulder, and eventually he succeeded in coaxing the first pair of young to take shelter under his own breast. A few days later I flushed both adults not far from each other, though a considerable distance from the nest, and they were each brooding two chicks, having apparently decided to go shares in the joys of parenthood!

The chicks are delightful little things, of a reddish chestnut colour mottled with black and white.

One of the peculiarities of the snipe is its habit of "drumming." This is, I believe, only indulged in during the breeding season. It is a curious sort of bleating sound very easily mistaken for the bleat of a lost lamb, and has, indeed, been known to delude the inexperienced shepherd. It is made by both birds as they fly backwards and forwards, often at a great height, but it is only heard on the downward flight, never in ascent. Most present-day naturalists attribute the sound to the two outer tail feathers being held out separate from the tail at a certain angle during descent.

The Common Sandpiper or Summer Snipe

The common sandpiper or summer snipe is another of the graceful family of waders to be found breeding on our shores. It will make its appearance in the early spring, and may be seen by small lakes or inland lochs and on the gravel shores of streams and rivers.

In the north of England and Scotland it is a common visitor, and though met with also in Ireland and Wales, it is seldom seen in the southern or eastern counties of England.

In colouring it is not a conspicuous bird; it shows yellowish brown on the upper parts and almost white on the breast and underneath, and were it not for its habit of choosing to perch on the extreme end of a rocky point or a spit of gravel jutting out into the water, it would be even less conspicuous than it is. Furthermore, sandpipers do not congregate in large numbers like most waders, but are content to feed in pairs or in small family parties of some five or six birds.

They move very rapidly on foot, running over the shingle or rocks at a great speed, and when flushed seldom rise more than a few feet from the ground, but skim the water from one point of vantage to another, uttering their call note of *wheet, wheet*, two or three times both in rising and when on the wing. Their food consists chiefly of worms and insects, and I have often watched them catching flies among the rocks and stones near their nests. The sandpiper shows great skill in hunting this small prey, stalking it warily, and then, when near enough, suddenly darting out its long, sharp beak and nabbing the victim.

Nesting Habits of the Sandpiper

It is not until the end of May that the birds begin their nesting. The site chosen varies according to the district, but is seldom far from the water's edge. It may be in the grass, or amidst heather or bracken. I have found nests, occasionally, even among brambles on small rock islets in the middle of inland lochs.

In the county of Wigtownshire where my photographs were taken, several nests were located, and all contained the usual number of four eggs. In colour the eggs vary from buff to greenish brown and are spotted with shades of brown. The nest itself consists mainly of dried bents, and is not very deep, but fairly well concealed by undergrowth. Both male and female are practically alike in colour and size, and if not seen together are difficult to identify. For this reason it is also difficult to say if both birds incubate, but in all probability they do. I have seen one bird leave the nest, and within a few seconds the eggs are again covered, presumably by the second bird, who has been waiting at no great distance to relieve its mate. Incubation takes from seventeen to nineteen days, and the young soon leave the nest after hatching, to roam about with their parents at the water's edge in search of food. The adults show great distress if approached when the young are just hatched. They will fly round and round quite close or will run along the ground, feigning injury by dropping a wing or trailing a leg, in the hope of leading the intruder away from their precious chicks.

SANDPIPER AND YOUNG.

The Sandpipers' nest may be in the grass, or amongst heather and bracken, but it is seldom far from the water's edge.

It is not difficult, however, to approach them during the breeding season. They take kindly to the usual " hide " if a little pains be taken to camouflage it, and once they are accustomed to it, give no further trouble.

During a spell of very windy weather one of my hides (which I had left for a couple of days to watch some young curlews hatching) blew down and fell right across a nest of sandpiper's eggs. Fortunately it lodged on a small rock at the back of the nest, leaving room for the sandpipers to carry on their incubation, which apparently they did without being in the least disturbed.

These birds are very capable swimmers, and I have occasionally seen them cross small strips of water well out of their depth. On reaching the other side they showed no signs of being wet, as no doubt their feathers contain a certain amount of natural oil which enables them to swim without ill-effect.

The young when hatched are sandy brown in colour with mottlings and lines of black. Once they are out of the nest they are particularly difficult to find again as they harmonize so well with their surroundings. On the first sign of danger the old birds fly up with one or two warning notes, and the young at once crouch, flattening themselves on the ground and remain motionless until the coast is again clear. The sandpipers are, I think, some of the most difficult birds to photograph satisfactorily, except when sitting, owing to their wagtail-like movements. They are continually jerking their heads or flitting their tails; these extremities, indeed, are always on the see-saw, even when the birds are standing. The only way to overcome this difficulty is to give as fast an exposure as the light will permit, and fire off the shutter while the birds are actually in movement. The fraction of a second taken for the brain to convey its will to the hand controlling the shutter release, will then allow the exposure to synchronize with the brief moment during which the bird remains still, and in this way perhaps a small percentage of pictures may be secured, showing a sharp and clear image. Towards the end of August and the beginning of September sandpipers may be found wending their way to the coast, preparatory to their migration to warmer climes.

Although so plentifully met with in Scotland, sandpipers do not breed in the Orkneys and Shetlands, and it is doubtful if any but a chance bird or two visit these islands.

Young Sandpipers are sandy brown in colour with mottlings and lines of black. Once out of their nest they are very difficult to distinguish from their surroundings.

Photo: Richard Kearton, F.Z.S.

The Herring Gull is one of the most numerous of British sea-fowl. It feeds not only upon fish, but on worms, grubs, and refuse cast up by the waves.

44.—THE HERRING AND COMMON GULLS

By RICHARD KEARTON, F.Z.S., etc.

THE herring gull is one of the most numerous of British sea-fowl. It may be distinguished from the common gull by its larger size, its flesh-coloured instead of yellowish-green legs, and by the fact that its lower mandible is decorated at the angled part by a splash of red, whereas that of its relative is not.

It is very fond of fish, and no doubt earned its popular, or as the older scientific naturalists would say trivial, name by its habit of following and feeding upon shoals of young herrings. In the spring its food consists largely of worms and grubs, and in the Outer Hebrides I have seen it following the plough with the common gull in such prodigious numbers that the unfortunate husbandman was compelled to pursue his calling in old oilskins in order to save his clothes from the defiling droppings of the great cloud of birds flying round and overhead.

Few things cast up by the waves on a sandy beach come amiss to this voracious creature. Clams, mussels and other edible trifles that cannot be opened even by the strong beak of this bird are treated with very considerable sagacity. The bird seizes its prize, mounts the air to some height and drops it on a rock or other hard substance. The shell is shattered and the luckless bivalve quickly extracted and swallowed. I have watched a member of this species treat crabs on a rock very much

Photos: Richard Kearton, F.Z.S.

Young Herring Gulls are hatched fully clothed in down, and very soon are able to roam about in the neighbourhood of the nest.

as a song-thrush treats snails on its "anvil," and on one occasion observed one thrash the life out of a small eel before swallowing it.

The herring gull, like some of its kinsmen already treated in THE PAGEANT OF NATURE, is an inveterate egg thief, and the number of heads to be seen adorning the "larders" of Highland keepers testify to their opinion of it on a grouse moor. In fact, it is considered the very worst member of its family in this respect.

I once had a desperate tussle with a herring gull in the act of swallowing a young lapwing almost old enough to fly. Attracted by the distress cries of the mother peewit who was trying to save her offspring, I gave chase. The gull could apparently neither swallow nor eject its prey, and was so far spent by its efforts that it could not rise, but ran along a bare hillside. I gained upon it for a while, but at last my breath and strength gave out and I was compelled to stop. The murderer did ditto, and by a series of desperate efforts gulped its prey down and, rising into the air, sailed away and alighted on the surface of a small loch below.

This species breeds on ledges of maritime cliffs, on the ground in a few suitable inland marshes, and on islands surrounded by either fresh or salt water. The nest is a somewhat untidy structure, made of any kind of suitable materials lying about near at hand. Some years ago I made a rather elaborate hiding contrivance on a small Scottish island tenanted by a large number of herring gulls on

The Herring Gull's nest is a somewhat untidy structure, made of any suitable materials that may be lying about to hand.

Photo: R. Kearton, F.Z.S.

The Common Gull nests on the ground amongst heather or grass, or on ledges and corners of rock, but seldom in any place that cannot be visited safely on foot or in a boat.

Photo: R. Kearton, F.Z.S.

Young Common Gulls leave the nest soon after they are hatched, and begin to wander about in the neighbourhood of their home.

A GATHERING OF HERRING GULLS
Few things cast up by the waves on a sandy

Photo: F. D. Ratar.

WHERE FOOD IS PLENTIFUL.
beach come amiss to this voracious creature.

breeding bent, and roofed it elaborately with heather, which I had to pull and carry some distance. Revisiting the island a few days later I was surprised to find my handiwork destroyed, and still more so to discover that the gulls had annexed nearly every sprig of my heather for nest-building purposes.

A colony of herring gulls, sitting on their nests in a forest of bluebells with here and there a great grey crag standing out covered with their dutiful mates and the deep blue sea as a background, makes a very pretty picture.

The eggs of this species usually number three, variable in ground colour and so similar to those of the lesser black back that the only safe method of identification is to study the owner covering them.

The common gull is only entitled to its popular name in England during the autumn, winter and early spring, but in Scotland, where its chief breeding haunts are to be found, its name applies all the year round. It rarely breeds on the English coast.

So far as my knowledge carries me it has only been found nesting on the Solway, the Farne Islands, and at Dungeness, in Kent, during the last two decades or so, and in the two latter instances only in isolated pairs.

It does not differ in its habits very widely from the other members of the gull family, and for purposes of identification I have already pointed out wherein it varies from the only other species with which it is likely to be confused.

My friend Mr. T. A. Coward claims that the common gull is more regular than the other members of the family *Laridæ* in dropping bivalves on rocks or sand in order to break open the shells, and that "it will paddle in shallow water or wet sand dancing or marking time to bring worms to the surface."

In the Outer Hebrides it has developed the nightjar-like habit of hawking moths. Night after night I have watched a number of these birds catching ghost moths in a field overlooked by my bedroom window, and the methodical way in which they flew to and fro over a patch of long grass growing in the shelter of an old stone wall was distinctly amusing. A dead rat would appear to be considered a great prize by the common gull judging from the tussles and excitement I have witnessed

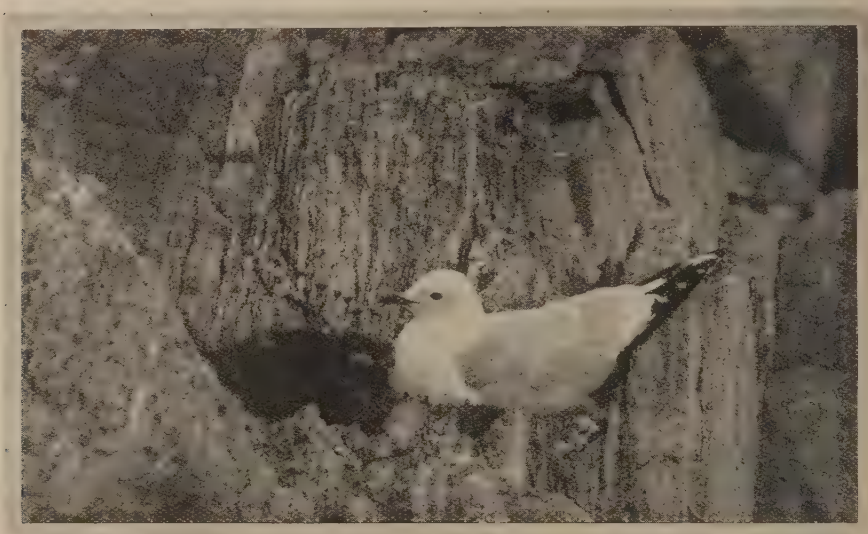


Photo: R. Kearton, F.Z.S.

The Common Gull is only entitled to its popular name in England during the autumn, winter and early spring, but in Scotland its name applies all the year round.

Photo: R. Kearton, F.Z.S.

It is said to be some four or five years before the Common Gull attains its adult plumage, and is able to begin nest-making on its own account.

over the possession of carrion of this character. Alas, however, the tables are badly turned upon occasion. On some quite small maritime islands common brown rats, that grow to great size, live all the year round. In the winter they subsist upon such edible flotsam and jetsam as the tide may throw up, limpets and small crabs, but in the spring they vary their diet by consuming the eggs and young of any sea-fowl foolish enough to adopt such an island for breeding purposes. I have known them kill and eat common gulls on the nest.

These gulls nest on the ground amongst heather or grass, on ledges and in corners of rock. Personally I have never found them nesting where the situation could not be easily and safely visited on foot or in a boat.

Although more or less gregarious I have found isolated pairs breeding amongst great hummocks of rock on the shores of the Atlantic, and have known a nest on a boulder in the middle of a freshwater loch. The structure consists of a collection of heather, grass and dead seaweed. The eggs generally number three, of an olive brown to chocolate ground colour, with black or reddish brown spots and streaks fairly evenly spread. The young ones leave the nest shortly after they are hatched, and soon take to the water.

Photo: R. Kearton, F.Z.S

The Common Gull is smaller than the Herring Gull, and lacks the latter's splash of red under the lower mandible. Its legs also are greenish yellow instead of being flesh-colour.

Photo: Riley Fortune, F.Z.S.

The Golden Eye forms a link between the freshwater ducks and the sea ducks. It prefers the more or less brackish waters of tidal rivers to the open sea.

45.—DUCKS THAT DIVE FOR A LIVING

By CHARLES S. BAYNE

THE two commonest of our diving ducks are the pochard and the tufted duck. These are both freshwater species, and as considerable numbers of them breed in the British Isles, and large flocks of them spend the winter on our lakes, it is easy to study them and compare them with the mallard and other surface-feeding ducks. The pochard may be known at close quarters from all other freshwater ducks by its silvery back and red head, and the tufted duck by its plumage being all black with the exception of a large white patch on the wings, and by the tuft of long feathers that hangs down the back of its head. At a distance, however, it is not always possible, even with good field-glasses, to see colours clearly, and in some conditions of the light, or on bright days when the sun's rays strike the observer at certain angles, all the ducks in a large flock may seem alike to a novice. But even in such circumstances it is not difficult to distinguish the diving ducks from the surface-feeders, and when that has been done concentration on an individual will usually result in identification.

One of the well-known signs is the manner in which the bird carries its head. Diving ducks have short necks, and when they are swimming they hold their heads close in between the shoulders. Another, and still more reliable one, is the manner in which it carries its tail. Diving ducks swim lower in the water than the surface-feeders, and as a rule drag their tails behind them, whereas the tail of a surface-feeder is usually held clear of the water. In this respect the two types differ as distinctly as a motor-boat does from a yacht. These interesting characteristics should be studied carefully by beginners, as when the eye is familiar with them it instinctively singles out one type from the other,

and so saves time and many a disappointment.

It is never easy to identify ducks in flight. Some observers of long experience can do it readily enough, and their skill is at first a complete puzzle to the novice. But if you can say definitely that the birds are diving ducks or surface-feeders as the case may be, you have made a good beginning, for you have at once reduced the number of possible species by about half. This is not difficult, for the wings of the two types differ in form. Those of the surface-feeders are comparatively long and pointed, those of the diving ducks short and rounded. An experienced eye will make this first elimination the moment the birds leave the water and before the shape of the wings is clearly visible. This is because each of the groups has a characteristic manner of taking to flight, which is no doubt due largely to the length and shape of the wing. The mallard and other members of its group rise easily and sometimes almost perpendicularly from the water, whereas the diving ducks get up with difficulty, running along the surface for some distance with a great splashing of the wings before they actually attain the freedom of the air. This difference is in conformity with the habits of the two types, for the former may be surprised among reeds or in narrow channels where escape is only possible by a quick upward flight, while the latter being lovers of deep water have no need of such heroic measures.

If you were to compare stuffed specimens of the various species you would find that the legs of the diving ducks are placed farther to the rear than those of the surface-feeders, and, moreover, that their hind toes are large and are provided with a lobe on the side next the foot, those of the other group being short and not lobed. In consequence of the peculiar position of their legs the diving ducks walk awkwardly and with considerable difficulty, and, indeed, some species seldom if ever venture upon land except at nesting time. On the other

Photo: Stanley Crook.

Nest of a Scoter Duck. The Scoters, so-called because they "scout," are among the first of the winter birds to reach our country in autumn.

hand, there can be no doubt as to their superiority as swimmers and divers. The rearward position of the legs is characteristic of diving birds, so no doubt it is advantageous to them in their calling.

Duration of the Dive

As their food is obtained at a considerable depth they have to be able to remain under water long enough to enable them to find and secure it. Their powers in this respect vary. The little tufted duck dives very frequently, and in my experience never exceeds the half minute by more than a second or two, and very often it returns to the surface after being down only a few seconds. Some of the sea ducks, however, which have as a rule to reach much greater depths, can spend a minute or more under water. It is easy to time these birds, because they always come to the surface again close to where they dived. In this they differ from the grebes and other diving birds, which usually come up far from the spot where they disappeared.

The reason for this difference is to be found in the nature of the food of the various species. Grebes and some other divers hunt fish and so must follow where the quarry leads, and when they have caught a victim they bring it to the surface and dispose of it there. Diving ducks, on the other hand, go right to the bottom, take and swallow shellfish and snails, water insects and other creatures that are more or less sedentary and may be found hiding among the water-weeds or under stones or perhaps partly hidden in the mud. Some of them also eat water-weed, the pochard and the tufted duck in particular, and when they do this they often bring a large portion to the surface and eat it there.

When they dive the plunge takes them well under, but they are so light and buoyant that they can only complete the descent and keep themselves in a position to feed by paddling vigorously with their feet. When they have reached the limit of their endurance they simply stop paddling, and at once bounce up to the surface like a cork.

The diet of the pochard is chiefly vegetable, but is varied with a certain amount of animal fare. On the other hand, the tufted duck preys largely on the small animal forms that inhabit our ponds, such as snails, tadpoles, insects, etc., but also indulges in an occasional snack of water-weed.

Both are very strictly freshwater species, and when they are disturbed they are very loth to leave the vicinity of their chosen quarters. In hard weather, however, they may frequently be seen on brackish water, such as the tidal reaches of the Thames.

The golden eye, on the other hand, forms a link between the freshwater ducks and the sea ducks. It is not an uncommon visitor to inland lakes, but it is really a sea duck, though it prefers the more or less brackish waters of estuaries and tidal rivers to the open sea. In such localities it is common in autumn and winter, but curiously enough in its more southerly quarters the majority of individuals are immature. It is a hardy bird, and as it is never frozen out of its favourite feeding grounds, as the freshwater species so often are, it seems unwilling to come farther south than it need. Consequently flocks seen in the north of Scotland will be composed almost entirely of adults.

How the Scaup Earns its Living

The scaup duck is still more of a sea duck. In autumn and winter it is common in broad estuaries and round the coast wherever mussels are plentiful. These shellfish form its staple diet, and from the fact that it frequents the mussel beds, or mussel-scaups as they are called in some parts (the word scalp or scaup originally meant a shell), the bird derives its name.

The scaup duck does not wait until the receding tide has exposed the mussels. It prefers to work for its living, and does so by diving in water of from one to three fathoms. As mussels, wherever they occur, are usually very abundant, a flock of scaup duck may be watched busy in this pursuit for an hour or two at a time, and may be expected to return to the same spot next day. While thus engaged they do not keep in a body as freshwater ducks do, but usually stretch out in single file, all operating about the same distance from the shore. But even so they are so well in touch with each other that if the bird at the end of the line is disturbed and takes

to flight the rest follow suit in regular order. It is a fine sight to see them rising thus, like the tail of a huge kite. Frequently they keep in this formation when on the wing, but if they are travelling any distance and their numbers are considerable they usually keep together in a compact flock.

Like the scaup duck, they frequently range themselves in a long line when feeding, and they seem to practise follow-my-leader in their diving. You may see the whole flock on the surface, then one or two at an end will plunge and the remainder repeat the action in order all along the line as if they were engaged in a handicap. They all appear again within a second or two of each other, and the males at once begin to call sociably like a lot of golfers talking about their shots. This habit may be due to the fact that they feed so far from the shore that they have no need to fear attack, and so require no sentinels.

Photo: G. C. S. Ingram, M.B.O.U.

The Scaup Duck does not wait until the receding tide has exposed the mussels, but prefers to dive for them, in water sometimes three fathoms deep. One is here seen in the company of two Coots.

The long-tailed duck is still more of a sea-lover. It avoids estuaries, dives in water of from two to five fathoms in depth, and is seldom seen except from boats. It might be thought that the long tail of the drake would be an easy means of identification. But this, as a rule, is trailed in the water and is only held erect when the bird is either alarmed or excited. It is seen, however, when the drake dives, for then with the curved neck and body it forms an arc. The birds may be easily recognized by the fact that they are very garrulous, the drakes constantly uttering their curious note which sounds somewhat like *coralie*.

The scoter is so called not because it scoots but because it scouts. It is one of the first of the nothern ducks to reach our coasts. The first flocks arrive about the end of August, and as they are the advance guard of the great army of invasion from the north they are the scout battalion, hence scouters or scoters.

The common scoter, which is the scout species, is a large duck, and is all black except for part of its bill, which is orange. The velvet scoter is a larger bird and is also black. The velvety nature of its blackness can be seen only at very close quarters, that is, when it is dead or in captivity, but the species may quite easily be distinguished by the fact that it has a large white patch on its wings which is very conspicuous when the bird is in flight. It is still more exclusively an ocean duck than its cousin, and seems to be perfectly happy in the roughest seas. This species is one of the last of the northern ducks to reach our shores; it arrives about the end of November. Both species, however, may be found in small parties feeding in estuaries, and the first velvet scoter I saw was busy in a very narrow channel which runs through the huge waste of sand that lies to the north of Wells, Norfolk, and is exposed at low water. The bird was about two hundred yards below high-water mark, but very much farther from the sea. When it caught sight of me it flew characteristically a foot or so above the surface for a little distance towards the sea, but then alighted on a spit of sand and preened itself. It is most unusual for this duck to rest ashore in winter.

The eider is the king of the diving ducks, in that it can go down to a greater depth and remain longer under water than any of the others. It can secure its favourite razor-shellfish in water of forty feet or more with ease. It prefers deep water, and the wildest seas have no terrors for it. It often goes ashore, however, to sleep and attend to its toilet, which is apparently a very important matter with all species of duck. Nevertheless, it walks with difficulty, and never ventures more than a yard or two from the wash of the sea.

Photo: M. Best.

The Eider Duck is the king of diving ducks, and can remain longer under water than any of the others. On land it walks with difficulty, and never ventures more than a yard or two from the wash of the sea.

Photo. G. C. S. Ingram, M.B.O.U.

A TUFTED DUCK WITH HER FAMILY.

Diving ducks swim much lower in the water than the surface feeders, and as a rule drag their tails behind them.

Photo: W. H. Nettlefield.

A bunch of young Kingfishers newly fledged, brought out to sun themselves at the lip of the burrow. They are clothed from the first in the same bright colours as the parents.

46.—THE KINGFISHER

By DR. FRANCIS WARD, F.Z.S.

THE unit marched out of camp at 6 a.m. It turned out an oppressive day, and every now and then a gust of hot wind picked up the germ-laden dust off the filthy road to carry it into our eyes. It was a trying march for the men, to end up with a weary tramp over five miles of sand, for we had to cross the sand-dunes to get to the sea. We were on the very left of the coastal sector, following the retiring Turk in Palestine. But next morning was bright and fresh ; the sea was just below, and so there was a chance of a dip before we started again.

I was going into the water, when I saw right in front of me, hovering like a kestrel, over the surf, the beautiful blue bird, our own glorious kingfisher (*Alcedo ispida L.*). There was no doubt about it ; it was the same species that I had last seen two years before on a peaceful English stream. This bird flashed like a thousand jewels, as with vibrating emerald wing he hung poised over the edge of the incoming tide. Suddenly, with quick turn and lightning flight he darted into the eddying surf, then as quick, back again with his capture in his bill. This swallowed, he continued to hover.

The kingfisher was some twenty yards away, and I could not make out the food, so I sent for my field-glasses and, dressed for a bathe, watched him fish ; he was catching small crustaceans. The bathe was off. I began to look around ; all along the waterline kingfishers were feeding in a similar manner. As a rule, when they made a cap-

ture they flew to the nearest stone, disposed of their prey, and then returned to hover; when apparently they had had enough, or were tired, they flew to the rocks under the cliffs and sat together in groups of three or four.

It was a kingfisher migration of the very same bird that we have at home, for *Alcedo ispida* has a very wide distribution throughout Europe, Asia and Africa; these birds were on the move along the Palestine coast. A partial migration of the kingfisher occurs at home; it is doubtful whether many cross the water, but there is certainly a general movement down the east coast, where these birds can be seen feeding in the same way as I saw them on that glorious morning by the Mediterranean Sea.

The Kingfisher's Nesting-hole

I went back to our bivouac camp, and while I waited for the unit to move, my mind wandered away to a lovely cool, deep pool on a Yorkshire stream—where at a bend on the river on the opposite bank an ash tree grew by the water's edge and a big bough overhung the pool. Under that bough a trout was feeding; twice had I got hung up and broken in my endeavours to reach him. When like a streak of light, downstream, came the emerald bird, straight for the bank under the ash; and he had a fish in his bill. Although he had seen me, he did not check, but simply switched off half-right, and swept away round the bend. I looked, and there on the opposite bank was an oval hole in the sand, about a foot below the grass; so I moved on, for undoubtedly that bird had young, and young kingfishers are voracious feeders and doubtless wanted their food.

At home, kingfishers pair in April, not infrequently they return to the same nesting spot year after year. The place where I made most of my observations was on the Chantry Pond near Ipswich; here the same nesting-hole was used during three successive years.

Some writers state that the hole of a water-rat is sometimes enlarged and altered to suit the bird, or that the kingfisher uses the nesting-hole of a sand-martin; personally I have never seen a tunnel that was not obviously the work of the birds themselves.

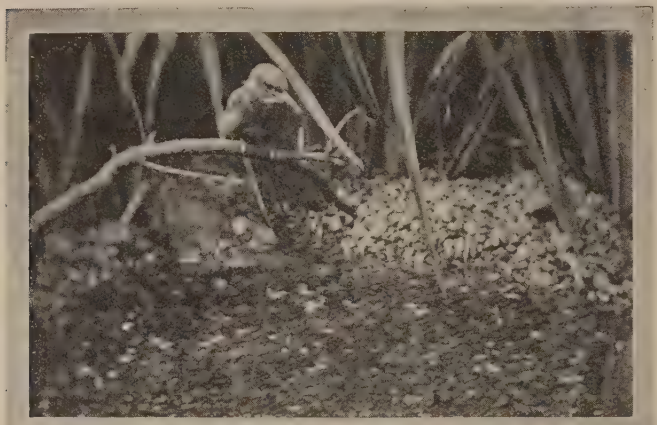
When a new burrow has to be made, a depression where a stone has fallen out of a sandbank, or some irregularity on the surface which gives a foothold, is selected as the starting point for the digging operations. Failing this, the bird makes a place for a foothold in the following manner. From a distance of about six feet the kingfisher flies from the ground or from an adjacent bough, straight at a sandbank, driving the bill well into the sand; the bird then drops, and the bill, acting as a lever, forces out an appreciable quantity of sand. This process may have to be repeated several times, but each time the bill is driven right into the hole with absolute precision. In this way, ultimately a good foothold is obtained. The female bird now commences to dig with the beak, while the feet are used to throw out the sand. Examination of a burrow will reveal beak-marks all along the roof and sides right to the end. As soon as the hen has disappeared the male bird follows in to assist, but when only just behind his mate he gets his eyes filled up with dirt. I shall never forget a cock kingfisher being treated this way on the Hodder, so that he went and sat on a root near by and expressed his resentment. The bird was angry—it was obvious he was very angry—and it would have been interesting to have understood his language. Later, when the burrow is longer, both birds manage to work together in peace.

The hole itself is about two inches in diameter, and is usually dug one to two feet from the top of the bank. The usual length of a burrow is just over two feet, but when the sand is soft it may be extended to three.

The Nest and Eggs

The eggs, of which there are almost invariably seven, are laid at the end of the completed tunnel within thirty days. Should the first nest be destroyed the birds will work much faster at the second, and all is ready for the commencement of incubation within seventeen to twenty-one days.

The question is always cropping up as to whether the kingfisher deliberately uses the fish bones from cast-up pellets to make a nest. I have found these birds vary very much in this matter. Sometimes the eggs are on the bare ground: at other times an



Photos from Kinemat'ograph Film: Dr. Francis Ward, F.Z.S.

Kingfisher catching a small trout. (Top) The bird on the look out; (middle) leaving the bough to dive; (bottom) flying out of the water with the fish.

attempt to collect these castings around the eggs does seem to have been made; where the attempt is due to the movements of the hen, the castings adhere in the shape of a shallow cup.

Mr. Ridley, a well-known Lancashire naturalist, goes further and suggests that the kingfisher deliberately takes the castings from outside into the end of the burrow. He describes how, on one occasion, pellets were left along the ridges on a sand-bank where kingfishers were digging; after a time these pellets disappeared, and when he examined the nest he found two eggs, with large quantities of pellets far more than it was possible for the female to have thrown up during the short time that she had occupied the burrow. This nest-forming instinct, when it exists in individual birds, is probably a link with the past, for the kingfisher was not always a tunnel-dweller.

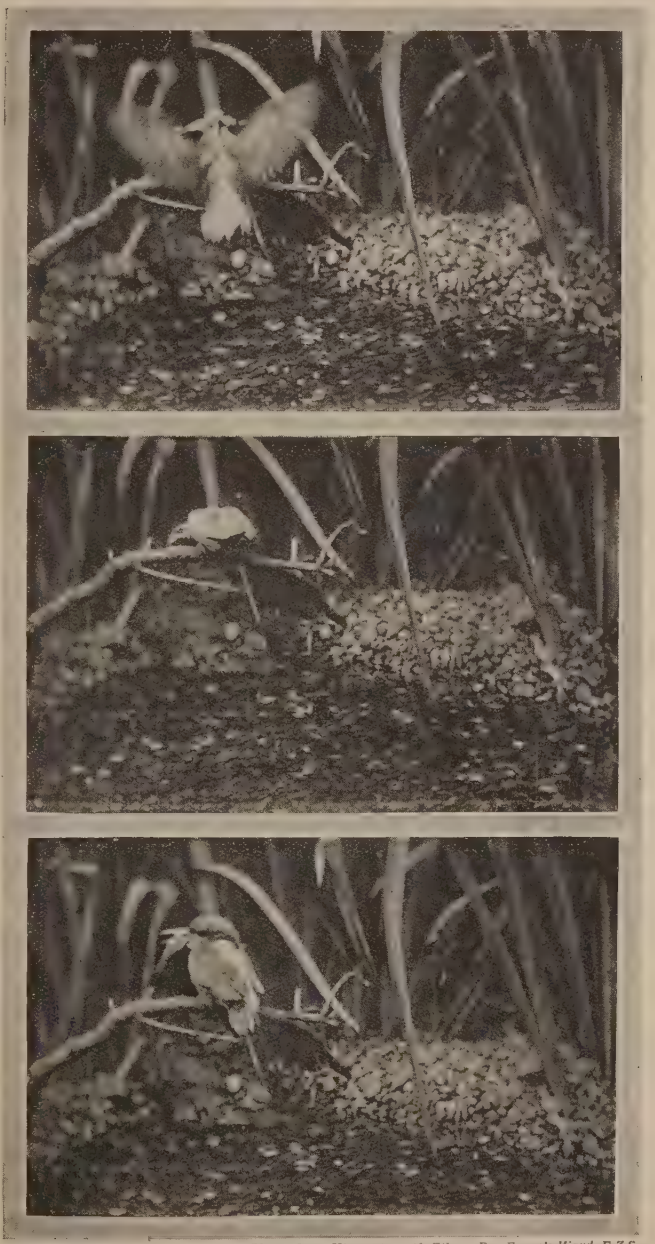
It is usual to think of the kingfisher as a fish-feeding bird which is invariably found by the waterside. The kingfisher family, however, consists of water-kingfishers and wood-kingfishers, and of these there are over one hundred and fifty species. The former are found at home mostly on shady

brooks and running streams; they mainly live on small fish, with insects and crustaceans as a variation. Wood-kingfishers dwell in forest regions, not necessarily by water. Their food consists of insects, reptiles, crustaceans, with occasionally small fish.

While the hen is brooding the male bird brings food to his mate; after the youngsters are a few days old both parents have to work hard to keep their family satisfied.

When first hatched the young kingfisher is an ugly object, blind and without any down on his body; the feathers that are going to cover him are in sheaths buried in the skin. Later these sheaths stick out like so many spines. These sheathed feathers are his permanent plumage, and presently they burst forth in all their beauty, and the young kingfisher acquires straight away the appearance and brilliance of his parent.

To revert to the nest; soon after the young are hatched they struggle into the passage-way. The floor of this is in a filthy mess with decomposing food, excreta and casts, and the smell is most offensive. In these uncongenial surroundings the young



Photos from Kinematograph Film: Dr. Francis Ward, F.Z.S.

(Top) Kingfisher returning with spread-eagle wings; (middle) nearly overbalanced by the weight of the fish as he suddenly closed his wings; (bottom) preparing to kill his prey.

Photos from Kinematograph Film: Dr. Francis Ward, F.Z.S.

Top) First he bangs the fish on the bough until it is dead; (middle) then he moves it until he has got it by the head; (bottom) the fish is then swallowed head first in spasmodic gulps.

brood is constantly fed; at first fish or other food is given to them, later it is dropped in the passage. At last the youngsters come out and often sit in a row along a bough or root of a tree. Here they make a truly beautiful picture. Now the exertions of the parents have to be redoubled, for the young kingfisher's appetite is enormous. Backwards and forwards the cock and hen bird fly to their favourite fishing grounds, bringing now a minnow, now a small gudgeon or a stickleback, and occasionally a small trout fry; at other times a crayfish or freshwater shrimps, varied with mayfly, water-beetles, leeches—in fact, the parents supply a really mixed diet to their offspring.

Even when the water is suitable the old birds never fish near their nest—probably so as not to reveal its position by the presence of their droppings—but fly up and down the river, as often as not to turn up a dyke or trickling stream than to take their accustomed places on their usual fishing grounds.

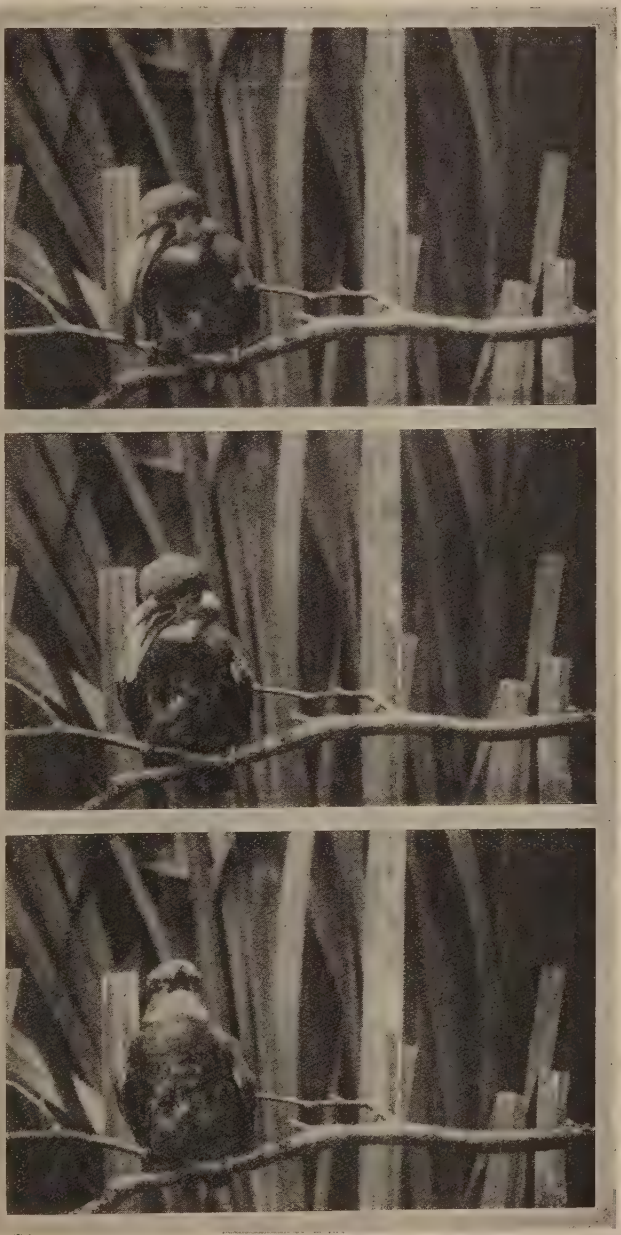
The kingfisher generally fishes in shallow water. Perched on a bough or stick he watches the water; suddenly he becomes all alert, his feathers tighten, and he may

sway forward a time or two. A shoal of minnows are now in the water at, say, an angle of 45° from him; he suddenly spreads his wings, flies down with a splash into the water, and soon—flying all the time—he catches up his fish, then back to his perch.

Arrived, his wings rapidly close and he nearly overbalances, owing to the sudden check. Then he turns round, and first he kills his prey by banging it on the branch; if for his young he flies back with it, if for himself, he swallows it, head first, with a series of gulps.

A kingfisher always kills his fish before swallowing it, the probable reason being to prevent its escape while it is being turned. Young kingfishers by instinct bang all their food in this way.

On one occasion I reared a nestful of young birds which flew about in the netted enclosure over one of my ponds. When fish was not available they were fed on small pieces of meat. Once the bill of a youngster pierced a piece of meat and he could not get it down, so he banged and banged; after I started to count, that young kingfisher banged that piece of meat one hundred and forty times; at last it was devoured.



Photos from Kinematograph Film: Dr. Francis Ward, F.Z.S.

(Top) The fish is nearly half-swallowed; (middle) it has stuck awhile; (bottom) the fish swallowed, the bird looks as if saying: "There, I knew I could do it."

Wild Flowers and Their Ways

19.—UMBRELLA FLOWERS

By EDWARD STEP, F.L.S.

With photographs by the Author

NATURE has given so many valuable hints to the inventor of contrivances most useful in the everyday life of the human family that it would not be surprising to learn that the original umbrella was suggested by the flower cluster of some such common plant as the cow parsnip. If the reader glances at the photograph of this plant he will see that the slightly convex group of flowers is supported by a large number of short stalks that radiate from the very top of the stout flowering stem, much as the shorter inner ribs of an umbrella radiate from the ring that slides up and down the stick. If in the field you pull apart one of these floral umbrellas you will find that the process is repeated at the top of each of the short stalks.

The cow parsnip (*Heracleum sphondylium*), on account of its large size and its abundance, is a convenient representative of one of the largest of the families of flowering plants. Our islands alone produce about sixty of the some 1,400 different species known in various parts of the world. They have all got quite small flowers, usually white or yellow, which if produced singly could not be seen from a little distance. Apparently, the founder of the family *Umbelliferæ* found it impossible to develop her flowers to a size that would have made them fairly conspicuous, so she hit upon the plan of arranging a number of them in a flattish cluster, so that at a distance the little bouquet would have the advertising value of one large flower. This massing of tiny blossoms is altogether different from the plan adopted by the *Compositæ* to gain a similar measure of publicity: there, hundreds of stalkless florets are packed tightly together on a common platform, so that the student who wishes to understand

The Cow Parsnip is a good example of an umbrella flower. It will be seen that clusters of minute flowers are held up by stems radiating from a centre, and the arrangement is repeated at the top of each of the short stems.

The Fool's Parsley is poisonous; it may be distinguished from the Wild Parsley by the number of slender bracts which hang downwards from the umbrella.

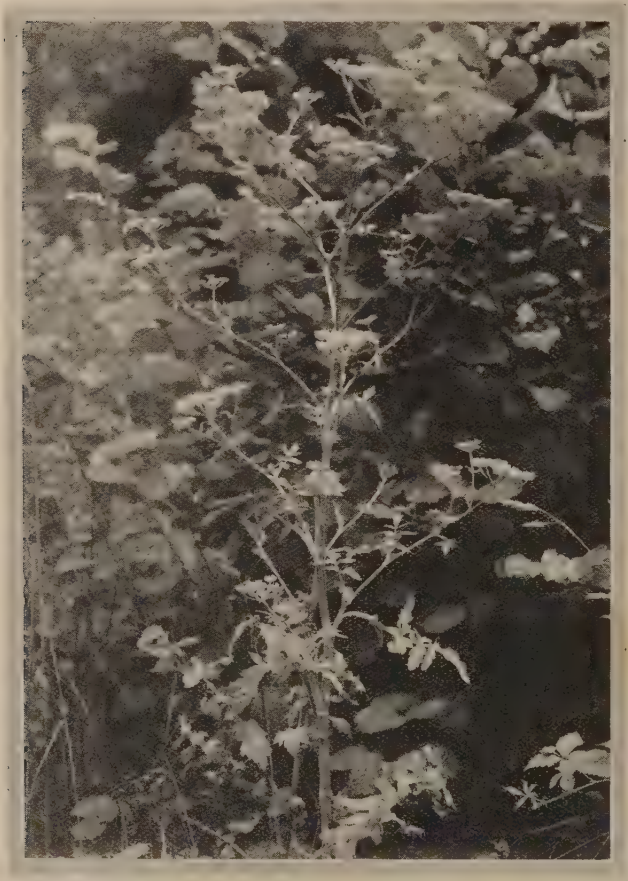
the structure of the individual has to resort to dissection. Every flower in an "umbrella" is separate and on its own foot-stalk, and the use of a simple pocket lens will make one acquainted with its details.

With this aid we find that each tiny flower is as completely formed as a rose or a poppy. It has a small calyx of five sepals, a corolla of five petals, five stamens surrounding a two-lobed disk, which is the top of the ovary, and each lobe runs up into a short style. Nectar is poured out upon the disk, so that insects with the shortest of tongues can lap it up comfortably. Such insects can get little or nothing from the specialized tubular flowers of many other plants; and, indeed, such plants do not welcome them. But, owing to the liberality of their arrangements, the umbrella flowers are very popular restaurants for a large number of insects. Butterflies and moths rarely visit them: their trunks are so exceedingly long that it is as irksome for them to quaff nectar from the flat disk as it was for the stork in the fable who was invited to drink from soup plates when a guest of the fox. But the honey-bee is a not infrequent visitor, though the most numerous patrons are to be found among the many two-winged flies and the smaller beetles.

Now, if in the field you make a dead set upon these umbrella flowers, and hunt out as many of the native kinds as you can find, you may get an inkling of the successive stages in the evolution of such fine masses as the cow parsnip. In plants like the marshwort, the sanicle and the sea-holly,

A curious feature about the Wild Carrot is that in the centre of the white flower-head there is one contrasting purplish flower.

the umbels are primitive and not well defined; on a casual glance you might not notice that they are umbels, though in the sanicle there is an effort to effect a combination of umbels—a compound umbel as it is termed. It is only in the compound umbels that the true umbrella shape is attained; but even in these higher forms there is a good deal of variation. In some of these we find evidence of co-operation among the flowers, for those forming the margin of the umbrella have the outer petals drawn out to give a more noticeable fringed appearance to the outline.



The Wild Parsnip of roadsides and pastures is one of the few umbellifers that have yellow flowers.

All our native umbellifers are herbs, some annuals, some biennials, others perennials; but most of them have characters by means of which it is easy, even before they have reached the flowering stage, to say that they are umbellifers of some sort. Their stems are jointed, and the length between two joints is hollow. The leaves are given off singly at the joint, at first from one side, then from the other; and the leaf-stalk at its base expands to such an extent that it wraps around the stem and in some cases produces the appearance of a greatly swollen joint. In a few cases, such as the marsh pennywort and the hare's-ears, the leaves are undivided; others have the leaves broken up into a number of simple leaflets, as in the marshwort and water parsnip; but in the majority the leaflets are again divided, and the result is a fernlike compound leaf as in carrot and hemlock.

As a whole the family is distinguished by poisonous properties and strong odours and flavours; but some are highly valued for their food-products, their medicinal and aromatic virtues. Noteworthy among the poisons are hemlock and cowbane; whilst umbellifers of economic value include celery (of which the wild original is common in marshy places), fennel, parsley, carrot and parsnip among everyday modern vegetables. Our forefathers made use of the coarse alexanders that are plentiful near the coast, and as a titbit the young shoots of sea-holly were eaten like asparagus and the roots candied to make a sweetmeat. Pignuts, which Caliban offered to dig with his long nails,

The umbrella form is not strikingly obvious in the Marshwort, but examination will show that it has the true umbelliferous structure.

are the tuberous roots of one of our native umbellifers. To-day they are left for children and pigs to grub for. Quite tasty morsels in the raw state, they are said to equal chestnuts when roasted. As cordials and flavourings the family has contributed handsomely to our needs under the names of anise, caraway, coriander, cummin and dill. To medicine it has given conine, asafetida, galbanum, etc.

Owing to similarities in the flowers and in the leaves of some of the smaller species, it is not always easy to determine with which member of a genus we are dealing; in such cases reference must be made to the characters of the fruit which in a general way agree throughout the family, but each genus has its distinctive difference which is modified in each species. The general plan of the fruit may be stated briefly. The ovary of an umbelliferous flower has two cells corresponding to the two lobes of the disk already mentioned, and as the ovary develops into the fruit it splits into two carpels, each suspended on a short branch from a central

Water Hemlock, or Cowbane, is a rare plant, probably because stock-owners have extirpated from their watercourses a plant so dangerous to cattle; although innocuous to goats, who eat it greedily.

bristle-like axis. Each carpel contains a single seed. On the outer face of the carpel there are several raised lines or strong ridges (according to the genus), and between these are brown marks which indicate the position of channels in the carpel wall, known as *vittæ* and containing an essential oil which makes some of these fruits valuable for flavouring. What we call caraway *seeds*, for example, are the *fruits* of an exotic umbellifer that has become naturalized in some of our wastes. Cow parsnip fruits serve well to illustrate this structure, as they are large enough to handle and can be gathered in plenty along every rough wayside. As they hang, lightly poised on their slender supports, they are detached by strong winds which carry them some yards beyond the parent plant. In some species, however, instead of relying upon the winds to distribute the fruits, the fur of mammals and the feathers of birds are regarded as more effective in securing their carriage over a much wider area. To this end our wild carrot and bur parsley clothe their fruits with hooked prickles that cling to one's dress as tenaciously as do those of the field forget-me-not and the agrimony. The shepherd's-needle, that is common in many cornfields, produces slender cylindrical fruits a couple of inches in length, and when these are ripe the two parts separate with a violent jerk.

The Hemlock competes with the Cowbane and the Hemlock Water-dropwort for the dubious distinction of having furnished the draught that destroyed Socrates.

In the photographs of some of our common umbrella plants here given, it should be noted that the cow parsnip differs from most of the others in the rather coarse, hairy character of its foliage. Its leaves

Hedge Parsley may sometimes be mistaken for Fool's Parsley, but it has not the same hanging bracts, neither has it such an objectionable smell.

may be a yard in length, divided into a few opposite leaflets which are cut into large lobes. The stout stem, which may be as much as six feet in height, is strongly grooved lengthwise and bristly. When young and tender it may be eaten like its relation archangelica, but when old and dry its cosy hollow serves as a secure winter resort for small snails, earwigs, beetles, etc. The entomologist on the look out for flies and beetles should always cast an eye over the umbrellas in summer: they will afford him many specimens.

In the matter of large leaflets, wild parsnip and angelica agree somewhat with cow parsnip, though in each case the general appearance, as well as the details, is so different that there is no risk of confusing them. Wild parsnip (*Pastinaca sativa*) of roadsides and pastures, for example, is one of our few umbellifers that have yellow flowers. Moreover, its leaves are so like those of the garden parsnip that anyone who has grown or seen growing the latter succulent vegetable would identify it at once. It is really the ancestor from whose stick-like roots have been evolved by selection and liberal treatment the large marrow-like parsnips of the garden. A similar process has produced the tender and juicy modern carrot from the tough root of the wild carrot (*Daucus carota*). This wild carrot, found plentifully in fields and by roadsides throughout the country, is one of our most beautiful plants. The root-leaves are very finely dissected, and the dense flower

The poisonous Water-dropwort is fairly common amongst the sedges and horsetails of the streamsides

masses on their straight, bristly stems are given a light appearance by the long, branching bracts that stand out all around them. A noticeable feature about these white umbrellas is that in the centre there is just one contrasting purplish flower. The closely-allied seaside carrot is by some authorities considered only a sub-species, whilst others raise it to species rank under the name of *Daucus gummifer*. Points of difference will be found in the facts that whilst *carota* branches chiefly in the upper portion, *gummifer* branches at its base; the flower mass of the former is somewhat concave, that of the latter convex and its broader leaflets more fleshy. The concavity and convexity are accentuated in the fruiting stage.

The Sea-holly is also an umbrella plant, but the suppression of the flower-stalks bring all the bluish flowers into a compact head, which, for its better protection, is set off by a stiff, spiny collarette.

In strong contrast to the lace-like leaf of the wild carrot we have the rigid undivided leaf of the sea-holly (*Eryngium maritimum*), with firmer ribs and margin, the latter running out into sharp, flat spines. None but a botanist would regard this at sight as an umbrella plant owing to the suppression of the flower-stalks bringing all the bluish flowers into a compact head, set off by the stiff, spiny collarette that protects them from the assaults of any browsing beast that may wander along the sandy shore where it grows. The umbrella form is not strikingly obvious either in the small clusters of marshwort (*Apium nodiflorum*) that grows in the mud of every marsh and shallow ditch, or in the small globular masses of the woodland sanicle (*Sanicula Europaea*); but examination shows that they have the true umbelliferous structure. More correct in form are the flat flower masses of the fleshy-leaved samphire (*Crithmum maritimum*), but the dozen or so of small umbels of which the umbrella is composed keep themselves a trifle too far apart. This plant grows in clefts of the rocks and cliffs, and its woody perennial base by expansion acts as a wedge and helps to break up the face of the rock. The salt aromatic flavour of the juicy leaves is very characteristic, and the plant is gathered for pickling.

Among those that have the leaves of finer texture and more delicately divided, we have the fern-like beaked parsley or keck (*Chaerophyllum sylvestre*) of our waysides, and the very tall, straight-stemmed hemlock (*Conium maculatum*), readily distinguished by its objectionable mousy odour and the red or purple blotches on

A WAYSIDE GROUP.

Among those *Umbelliferæ* that have leaves of finer texture is the fernlike Beaked Parsley, or Keck, with its delicately divided foliage.

its smooth, though grooved stem. Well known from of old for its poisonous properties, the hemlock competes with water hemlock or cowbane (*Cicuta virosa*) and the hemlock water-dropwort (*Oenanthe crocata*) —all umbrella flowers—for the dubious distinction of having furnished the draught that destroyed Socrates. Water hemlock is rather a rare plant, probably because stock-owners have extirpated from their water-courses a plant so dangerous to their cattle. Hemlock water-dropwort is found commonly in marshes and by streamsides in the southern half of England. Its less leafy relation, the water-dropwort (*Oenanthe fistulosa*), is more widely distributed, and having for usual company sedges and horsetails, its leaf poverty is not noticeable.

Hemlock Water-dropwort is found commonly in marshes and by streamsides in the southern half of England.

Fennel (*Fœniculum vulgare*), which grows up many sea cliffs, has a tall, round, polished stem, and the segments of its much-divided dark green leaves are almost hair-like in their fineness. The cane-like stem is crowned by yellow umbels. This is another plant that has fallen upon evil days so far as human tastes are concerned. Time was when its fruits were in demand for flavouring pippin pies, its leaves to be boiled with fish, and the whole plant was strewn before newly married couples. Its aroma was so much appreciated in the past that Milton speaks of an odour that pleased his sense more than the scent of sweetest fennel.

The poisonous fool's parsley (*Aethusa cynapium*) is quite a graceful plant, though it is probable that the gardener rarely pauses to admire it, but makes short work of it with his hoe. For the fool's parsley is rarely seen away from cultivated ground. The leaves are supposed to bear a resemblance to those of the garden parsley; but the name suggests that only a simple person would be taken in by the likeness, having regard perhaps for the nauseous odour of the plant.

Hedge parsley (*Torilis anthriscus*) may sometimes be mistaken for fool's parsley, but it has much smaller flowers and umbrellas—sometimes pink, but mostly white—and these are without the hanging bracts; neither has it the objectionable smell. A remarkable member of the family may be met with in cornfields and the neighbouring wastes, especially on the chalk in the south and east of England. This is the hare's-ear (*Bupleurum rotundifolium*). The small yellow flowers form compound umbels; but the most striking feature of the flower clusters is the united bracts beneath them which have the form of a large calyx.

A RED-CRESTED POCHARD

Photograph by W. S. Berridge, F.Z.S.

MALE TUFTED DUCK UP FROM A DIVE

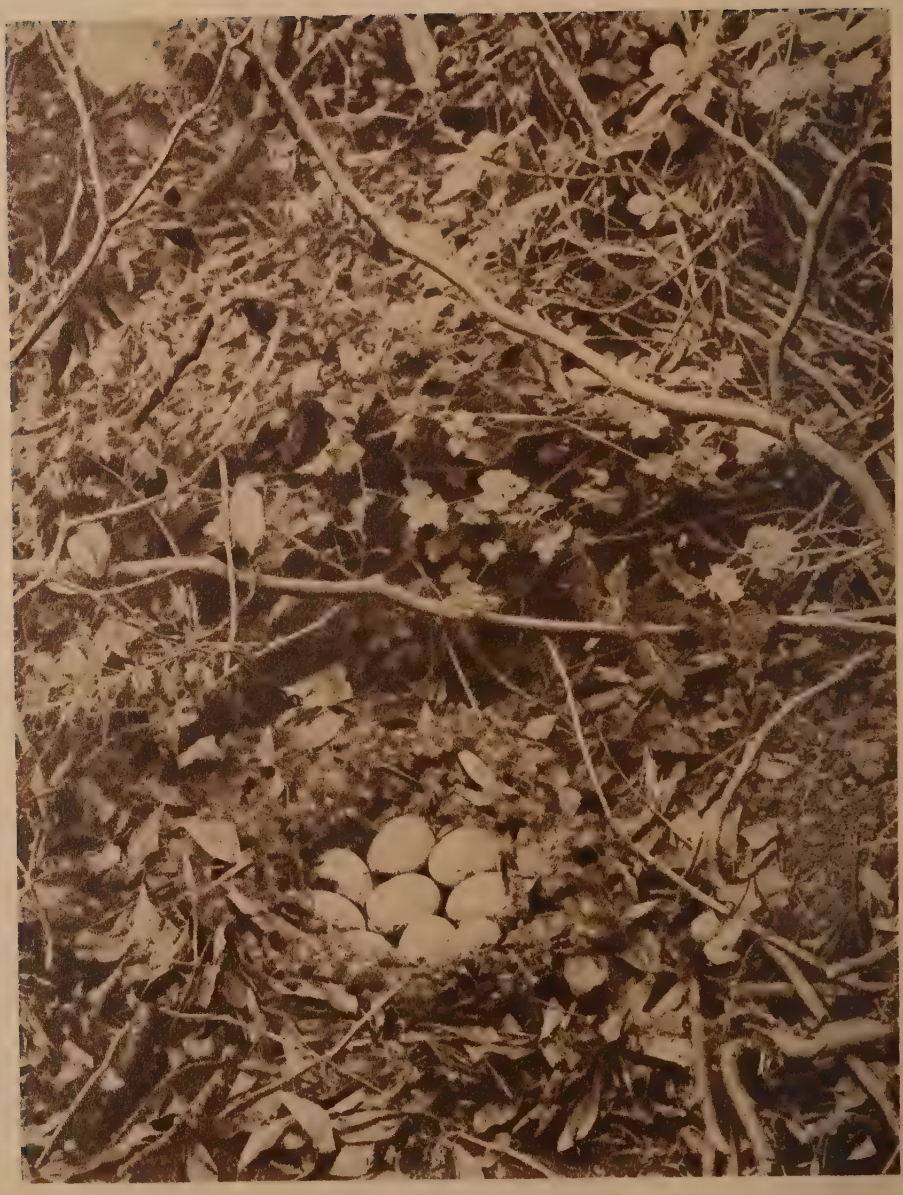
Photograph by G. C. S. Ingram, M.B.O.U.

TUFTED DUCKS IN SUMMERTIME

Photograph by Capt. H. Morrey Salmon, M.C.

AN EIDER DUCK ON ITS NEST

Photograph by M. Best



NEST OF THE TUFTED DUCK

Photograph by E. W. Tayler

Trees and Their Life Story

7.—THE TREE OF LONDON: "THE LONDON PLANE"

By G. CLARKE NUTTALL, B.Sc.

With photographs by the Author

IT is a very remarkable fact that the tree which has conquered London and made itself pre-eminent above all our native British trees in that city of smoke, grime and fog is a "sport" from a sun-loving alien, an alien that hails from the clear skies and sun-baked lands of Greece and the Near East. Once upon a time where London now stands the oak, the ash, and the thorn were supreme—

Oak of the Clay lived many a day
Or ever Æneas began;
Ash of the Loam was a lady at home
When Brut was an outlaw man.
Thorn of the Down saw New Troy Town
(From which was London born)
Witness hereby the ancientry
Of Oak and Ash and Thorn!

(RUDYARD KIPLING.)

but to-day the tree of London, the tree that lines its streets, graces its squares and flourishes where none other will, is not one of these three that were so long first in the field and the product of the land, but a plane, the tree beloved of the Greeks, beneath whose shade their philosophers taught, and a tree, moreover, that is, comparatively speaking, a new-comer to this country. Its history during the couple of centuries that it boasts to its credit as an ordinary inhabitant here is worth recalling.

A Seedling Plane Tree, showing the pair of spoon-shaped "seed-leaves," and the second and third leaves with toothed margins. The leaves to follow will all be lobed.

In the middle of the sixteenth century a certain Dr. William Turner mentioned in his "Herball" that he had seen "Two very young trees in England which were there called Playn trees," and he added: "It is doubtless that these two trees were either brought out of Italy or of some far countrie beyond Italy, where unto the freres, monkes and chanones (canons) went a pilgrimage." And this is the first time we hear of the plane in this country; but evidently the career of these two visitors was short, for nearly half a century later Gerard, in his "Grete Herball" describes the plane as only growing in foreign lands, and says that his servant, William Marshall, "whom I sent into the Mediterranean Sea as Chirugion unto the Hercules of London found divers trees hereof growing in Lepanto hard by the seaside . . . and from thence brought one of those rough buttons being the fruit thereof." But in an edition of the Herball thirty-nine years later (1636) a note is added that two young plane trees were then growing in the garden of a Mr. Tradescant, a renowned gardener, who imported many rare plants from abroad. (He was the founder of the Ashmolean Museum at Oxford.)

At this date, too, a plane that still flourishes was planted as a great curiosity by Dr. Pocock, the Professor of Arabic, in

In winter the branching of the Plane is revealed as rather indeterminate and wavering. It lacks character.

the garden of the Lady Margaret Professor of Divinity at Oxford. But it was not until the end of the seventeenth century that the ordinary cultivation of this tree began. To John Evelyn we owe the knowledge that "the introduction of this true Plane among us is due to that honourable gentleman, Sir George Crook, of Oxfordshire, from whose bounty I received a hopeful plant now growing in my villa." With prophetic vision he further asserts, "for our encouragement I do upon experience assure that they will flourish and abide with us without any more trouble than frequent and plentiful

A LONDON PLANE IN SUMMER FOLIAGE.

This is the celebrated tree at Ranelagh which holds the record for height—111 feet.

watering . . . so I am persuaded that with very ordinary industry they might be propagated to the incredible *ornament* of the walks and avenues to great men's houses." The finest plane in England to-day, a hundred feet high and with a trunk twenty feet in girth, was planted as a seedling at this time in the Palace Garden at Ely by Bishop Gunning.

A spring twig of a Plane. Out of a sheath little golden leaves clothed in thick hairs emerge. Several leaves come from the big terminal bud; only one leaf from the smaller lateral buds. The mature leaf is also shown.

But now a very interesting thing happened, one that meant much in the story of the plane. Among the seedlings appeared one that varied a little both from its parent the Oriental plane (*Platanus orientalis*) and from all the rest, particularly with regard to its leaves, and as this seedling grew it developed a definite character of its own. It was recognized very shortly as a distinct variety, and Tournefort, the well-known French botanist, gave it the name of *Platanus orientalis acerifolia*, that is, "the Oriental plane with leaves like the maple," but it was not fully studied and described until the middle of last century, when Sir Joseph Hooker turned his attention to it. It is now known shortly as *Platanus acerifolia*. This particular variety of plane has never been found wild in any other part of the world; it is just a "sport"—"the London plane"—which has become fixed by cultivation and to which the metropolis is peculiarly congenial. Certainly no other tree, so far as we know, has its power to withstand a smoke-laden atmosphere.

Green is the plane tree in the square,
The other trees are brown;
They droop and pine for country air;
The plane tree loves the town.

Among her branches, in and out,
The city breezes play;
The dun fog wraps her round about,
Above the smoke curls grey.

Others, the country take for choice,
And hold the town in scorn;
But she has listened to the voice
Of city breezes born.

(Amy Levy.)

To the virtue of being impervious to the evils of town life the plane adds that of being a remarkably quick grower, so now it is planted in London in greater numbers than all other trees put together; in fact, it is favoured almost to the exclusion of other kinds of trees. To-day, it is computed that sixty per cent. of the trees of the metropolis are plane trees.

The oldest plane trees of whose actual planting we have any record are those in Berkeley Square, which were put there as seedlings by a Mr. Bouverie in 1789. In Gray's Inn gardens there are a number of very large and fine trees of much the same age, one of them—the Wallace tree—near the main entrance, being particularly noticeable. Perhaps the largest plane tree of the City is found in the old churchyard of St. Dunstan's-in-the-East, hard by Billingsgate; it is eighty feet high, and flourishing in spite of its congested surroundings. In 1772 a writer remarked on the beauty of the planes at St. Dunstan's, and said that they were then forty feet high, so that they must have been planted about the middle of the eighteenth century.

It is really extraordinary in what con-

fined positions these London planes live happily. There is a well-known example at the corner of Wood Street and Cheapside, marking the site of the old church of St. Peter-in-Chepe; another, equally fine, in Stationers' Hall Court, Ludgate Hill, while two in Dean's Court are only a little less notable. The largest plane tree in the London area (111 feet high), and one of the most beautiful, is found opposite the club room at Ranelagh.

The London plane at its best is a very fine tree, over a hundred feet high, with its trunk as a tapering pillar running almost to the top of its great rounded head. Its leaves are triangular and cut into three or five lobes; they have a smooth shining surface, from which a shower of rain will remove all dirt. Though they are rather like those of the sycamore or maple, they differ in being placed singly on the branches, while on the latter trees the leaves are always in pairs. The flowers are very peculiar; indeed, in certain particulars they are a standing puzzle to botanists. They first appear as little "bobbles," several in a row on long stalks, hanging a little distance apart like beads on a knotted string, and they come in the spring before the leaves are fully grown. Some of them are small and yellow, the size of peas—these are collections of male flowers; others are larger, the size of marbles, and reddish in colour—these are collections of female flowers. The male and female balls are not mixed up together but hang on separate stalks, though all are on the same tree.

The remarkable flowers of the Plane; the smaller balls on the left are collections of male flowers; the larger on the right are collections of female flowers.

When one comes to examine these flower-heads closely one finds that the males are made up of many nail-shaped stamens set on a core; their heads, touching, form the surface of the ball. Mixed up among them are many scales and curious club-shaped bodies difficult to interpret. Within the ball, under the stamen heads, are cavities into which the pollen falls and where it is stored. The female balls have a green core on which are set innumerable little seed-cases, from each of which radiates a spike ending in a red hook, so that the whole ball looks like a burr. As in the smaller balls, there are here, too, many scales and hairs and mysterious club-like bodies between the individual seed-cases. When all are mature, certain stamens (or perhaps merely dummy stamens) fall out of the male balls like bits out of a mosaic, and through the gaps thus left the wind blows the dry pollen in little clouds. Some of it at least reaches the red hooks waiting expectantly on the female spheres, and thus the seeds in the seed-cases become fertilized.

Their work done, the male spheres fall off and disappear; but, as the summer days pass, the big female ones get still bigger, for the seed-cases swell, and round the base of each dry spike stiff yellow hairs grow up and form a parachute.

All through the autumn and winter these rough balls hang brown and dry and very noticeable upon the bare branches, but with the coming of the next spring the dry little fruits fall, one by one, out of the ball, leaving a fawn-coloured downy mass of hairs behind on the hard core. Each fruit being so small and dry and light is by means of its parachute carried hither and thither by the wind and so dispersed. From time

Plane tree shedding its bark in the autumn. No other tree acts quite in this way.

immemorial a certain suspicion has been rife that the hairs shed by the plane, both from the fruits and the young leaves, are injurious to man and cause bronchitis and a catarrh like hay fever. Some time ago the Southwark Borough Council had a definite complaint lodged with them *re* the planting of plane trees, on the ground that they gave "colds" to those living near them, but in this climate the dampness of the atmosphere probably checks the dispersal of the hairs and prevents much harm being done. In Alsace-Lorraine, however, it is forbidden to plant them near schools.

In autumn days the plane presents a pitiable sight. Not only does the bright green foliage yellow and thin as the leaves fall, but the whole trunk and the older branches begin to cast off their bark, so that instead of a coat of complete greyness, great patches of light yellowish wood appear, and the whole tree stands in motley garb —a veritable harlequin, as though it had been smitten with some deadly disease. It is now generally accepted that the reason why the plane can withstand the ill effects of the soot-laden air of London is because every autumn it has this thorough cleaning and sheds every particle of suffocating dirt with its leaves and bark, and is thus able to start again year by year as fresh and clean as a country tree. The suggestion would seem to commend itself as common sense, particularly as the shedding of the bark is the chief characteristic that marks off the plane from all those other native British trees that it has supplanted. Mr. W. J. Bean, the tree expert of Kew, does not, however, agree that this point is proved.

The plane springs another surprise upon us in the autumn. During the late summer all other trees are forming resting buds at the base of their leaf-stalks for development the following spring, but in the plane nothing of the sort can be seen. And yet when the leaves have fallen, there, all over the branches, are fully formed resting buds in watertight sheaths waiting, as on other trees, for the call of the spring. The explanation is that each bud is formed *inside* the hollow end of the leaf-stalk, as in a little hut, and when the leaf falls it is simply uncovered ready for its winter sleep. No other tree has adopted this trick. Like the shedding of the bark it is peculiar to the plane and to the plane alone. When spring comes the waterproof sheath splits, and above a round green structure a tiny leaf peeps like a jack-in-the-box. As it pushes up it can be seen to be a golden leaf, covered with golden hairs, on a long stalk. Then follows another leaf, also in a pulpit-like sheath, which often causes the older sheath to turn back like a frill. Three or four leaves may come out of the big bud at the end of a branch, but just one out of the smaller side buds.

The plane is usually raised from cuttings, which take root very easily, but it also produces plenty of good seed. As a seedling it is not particularly interesting. It starts

The ripe fruits of the Plane. Out of the lowermost ball on the left some of the downy hairs are falling. These, if inhaled, cause a sort of catarrh. One of the minute fruits with its hairy parachute is seen at the bottom right corner. The balls are collections of hundreds of these fruits.

with two little spoon-shaped leaves known as "seed-leaves"; then comes a minute leaf almost like a stalk, followed by two that have big teeth on their margins, and after these the ordinary three or five pointed leaves begin to appear. It does not seem to be at all particular as to the kind of soil in which it will grow.

Though Londoners value and admire their planes, yet modern habits of thought, together with the slower British temperament, do not allow them to run into the extreme excesses that marked the love and adulation of the ancients for this tree. Really incredible stories are told in this connexion. The following episode (here given in the quaint words of John Evelyn) is related of Xerxes, the great commander, and of "Platanus that so beautiful and precious tree, so doted on by Xerxes that he stop'd his prodigious army of 1,700,000 soldiers to admire the pulchritude and procesity of one of these goodly Trees, and became so fond of it that he covered it with gold, gemms, Neck-laces, Scarfs and bracelets and infinite riches. In sum was so enamoured of it that neither the concernment of his grand Expedition nor interest or honour nor the necessary motion of his portentous Army could persuade him from it. . . . When he was forced to part from it, he caus'd the figure of it to be stampt on a Medal of gold which he continually wore about him." The Romans were no whit behind the Greeks in their adulation, and of some of their statesmen it is told that they would leave their work midday, and go home "to refresh their Platans and even give them drinks of wine." One might hesitate to believe all this, but even in our own country we find a botanist, in the reign of Queen Elizabeth, insisting upon the wine: "It is found by experience that the same is very comfortable to the roots, and we have already taught that trees desire to drink wine," he says. Whether the plane desires wine or not, it has perforce become teetotal.

The formation of the bud in a Plane is a great surprise. It is born in a hut-like cavity in the stalk of the dying leaf, and is only revealed when the leaf falls in the autumn.

Photo: Charles Reid.

With his well-groomed coat and his alert demeanour, the Stoat strikes one as being a particularly smart and spruce little person, with much of the gentleman about him.

17.—THE LITTLE HIGHWAYMAN OF THE WOODS: THE STOAT

By FRANK BONNETT

YOUR old-fashioned highwayman, although his calling could never by any stretch of imagination come within the category of honourable professions, was in a sense a good sportsman. He was invariably armed, but took sporting chances; and while always careful to provide for his own security as far as possible, he was ever prepared to run risks in the pursuit of his more or less uncertain adventures.

So it is with the little highwayman of the woods—that small four-footed creature whose reputation in the eyes of the gamekeeper is as black as the tip of its tail. For the stoat, like the highwayman of yore, earns its livelihood by bare-faced depredation, caring nothing for the pain and misery it may inflict on others, yet all the time being ready to face the risks that are inseparable from its calling. Many, if not most, of these chances are, of course, of the unknown order; but is not that rather to the stoat's credit than otherwise? The highwayman knew that his deeds were illegitimate; his own conscience, however well smothered, must sometimes have told him what a rogue he was; so that whatever evil befell him, he must have realized that he was never getting more than his deserts.

But the stoat knows none of these things.

Photo: H. Mortimer Batten, F.Z.S.

A STOAT ON THE WARPATH.

Barring accidents, the Stoat must lead as happy a life as any denizen of the woodlands—probably happier than many.

Sometimes he realizes, perhaps, that there is a price upon his head; a charge of shot scattering about him just too late to do its intended work, may convey the impression that the gamekeeper cherishes no friendly feelings towards him, but he cannot be expected to understand that the mode of life which Nature has ordained for him is one of which few approve.

Nor is man his only enemy, though perhaps the greatest. The stoat is aware that he must steer clear of such enemies as the fox and the dog, while he knows his business well enough to avoid conflict also with such larger representatives of his own tribe as the wild polecat, or with the domesticated ferret. The former, thanks to the gamekeeper himself, he will not often meet, but the latter may come upon him when he least expects it. The rat, whom he regards as his lawful prey, may under certain circumstances prove more than a match for him; while even the rabbit—poor fighter that it is on most occasions—will sometimes contrive to hold its own against its most dreaded foe. Just as creatures of a higher order will risk life itself to defend their offspring, so sometimes will rat and rabbit throw their usual caution to the winds and fight with unwonted courage to defend their nurseries. Cases have been known in which stoats, and even ferrets, have come by their death in the rabbit burrow; usually when the rabbit has contrived to get its enemy fixed in the end of a " blind " hole and, by backing upon it, kills it by suffocation.

Ruthless and pitiless as he is in his methods of earning a livelihood, there is something to admire even in the stoat. He is not above stooping to mean and cunning ways, but no one can say that he is lacking in pluck; while his very daring—often under conditions that must at least strike him as suspicious—is not infrequently the cause of his undoing.

It is the habit of the mother stoat to keep in close touch with her family long after they are old enough to be independent of her for sustenance. Velveteens, taking advantage of this strong tie of family affection, will suspend, a foot or so above the ground, the dead body of the mother. Underneath, where nothing that ventures there can fail to come within reach of its cruel jaws, he sets his trap. One after the other, as the keeper well knows, the young ones will seek out their parent, and one by one each falls a victim to its devotion.

Photo: Charles Reid.

Though farmers and gamekeepers wage war against him, yet the Stoat's instinct for self-preservation enables him to triumph against all the means taken to extirpate him.

For since the stoat is not stupid, it can only be devotion that tempts it to run such risks in the face of so patent a warning.

In this and other ways, by various methods of trapping, by the destruction of the young when the nest is discovered, by means of dogs and by shooting, the keeper wages relentless war against the little highwayman of the woods. Farmers also, regarding the small creature as their natural enemy, lend their aid in the work of destruction whenever opportunity offers; and yet the stoat survives, and probably will survive to the end of the chapter. In a creature that has so many enemies among mankind, and certainly very few friends, this is a thing to marvel at, and shows very forcibly that in spite of the hazards that beset his adventurous existence, the stoat's instinct for self-preservation is able to triumph against all the means taken to exterminate him. Not improbably his wits have been sharpened by reason of these constant attempts upon his life, so that each succeeding generation of stoats becomes a little wiser.

It is in its early and inexperienced days, of course, that the stoat is most likely to fall a victim to disaster. The keeper knows that, and therefore puts forward his greatest efforts during that period of the year in which the younger members of the stoat family are about. Much depends on his ability to destroy the parents, for after that the rest is easy; but if he fail, the chances are that some at least of the rising generation will survive.

Barring accidents, the stoat must lead as happy a life as any denizen of woodland and hedgerow, probably a happier one than many. With his well-groomed coat, his lithe action and his always alert demeanour, he strikes one as being a particularly smart and spruce little person, with much of the sportsman and the gentleman about him. Wary though he is, there are times when, going softly along the ride, especially in the early morning when every wild creature that roams by daylight moves with greater confidence, one may come upon him unawares, and by keeping perfectly still may watch him for some minutes before he detects an enemy. Even when he does discover one's presence, he may not at once take fright. It is movement that alarms every wild creature; but a movement that can be seen is much more terrifying than mere sound caused by something invisible.

Photo: H. A. Wallace.

Wary though he is, there are times when going softly along one may come upon a Stoat unawares, and by keeping perfectly still may watch him for some minutes before he detects an enemy.

Whenever, then, it is possible to discover the stoat before he becomes aware of a stranger, a good view of him may be had in his natural haunts, and something learnt, perhaps, of his mode of life. It is worth remembering that if, without alarming it, the stoat can be detected as it passes on its way, it is by no means unlikely

Photo: H. Mortimer Batten, F.Z.S.

The Stoat is certainly the most relentless of all hunting animals in this country; he hunts by scent alone, and the pace at which he travels is surprising.

that other members of the family will come along close behind.

So far as one can discover, the stoat is a creature of no very regular habits. He hunts when he is hungry, and once satisfied, is usually content to sleep it off until he is hungry again. He is certainly the most relentless of all hunting animals in this country, and one may well believe that the rabbit on whose track he is once fairly set has but the remotest chance of escape. Stoats hunt by scent alone, and this sense is very highly developed. The pace at which they travel is also surprising, as anyone who has tried to overtake a stoat in the open will readily agree. The "little varmint" is credited with being able to exercise some sort of mesmerism over its ill-fated quarry. The apparent inability of the rabbit to escape when the pursuer is at last close at hand may, however, be as much due to exhaustion as to a loss of power from fright.

When hot on the scent, the little hunter is so occupied with his business that he will often take not the slightest notice of other things. He will pass quite close, even in the open, apparently without observing the fact that there is a spectator of his doings,

and once he pulls down his quarry, leaping on its back and fastening his sharp teeth in the victim's neck, he will never let go until life is extinct. So engrossed is he on such occasions that it is possible, as the writer has done more than once, to come within a few yards of the murderous little beast before he becomes aware of one's presence.

The stoat, however, does not always take his quarry above ground. Ferret-like, he will often invade the burrow of rat or rabbit, especially in the breeding season when, as he knows, the young will fall easy victims to his cruel jaws. No wonder, then, that the gamekeeper regards the little highwayman of the woods as one of his greatest foes, and it must be admitted that the mischief the stoat can achieve does not begin and end in the rabbit warren. Young pheasants and partridges, if he can light upon them separated from their parents, do not come amiss, and one of the worst features of the stoat's character is that he is, literally, always "out for blood." This means that having sucked the life-blood of one of his victims, he will, if his taste for gore remain unappeased, hurry off to treat another in similar fashion. It is only when food is scarce that he will trouble to eat even a part of the carcass, and the toll he takes of the smaller living creatures of the countryside is thereby all the heavier. It may also be supposed that, in common with the fox, the stoat often hunts and kills for the love of the thing and little else. He does not, however, confine himself to the articles of diet already mentioned. The stoat likes a varied bill of fare, and although it may be supposed that he prefers those creatures which are easily caught, he is sometimes obliged to work very hard for his living. At times he even climbs trees to pilfer birds' nests, and in the spring searches the banks and hedges pretty thoroughly for the young of ground-nesting birds.

As for the stoat's propensity for destroying rats, it is doubtful whether, in view of his many depredations in other directions, he gets much credit for this good office. Possibly the gamekeeper thinks he can deal himself with the mischievous rodent, though he does not always do it. If he did, the stoat might have even less justification for his existence, and he is probably less useful in this direction than the weasel, with whom the keeper has less cause to quarrel

Photo: Frances Pitt.

The rabbit on whose track a Stoat is once fairly set has small chance of escape.

The Fairyland of Nature

Pages for the Children

By OLIVE HOCKIN

Photo: Henry Irving.

"Before long they came out on the wild moor, where rocks and heather stretched away to the skyline."

XII.—A Day on the Moor

IT had been a night of storm, and when the children looked out of the window next morning it was to see a clean washed world—sky and trees and grass shining, and little ragged cloudlets scudding across the blue. A high wind was tearing through the grass bents, and from the garden they could hear the sea thundering savagely at the foot of the cliffs.

With streaming hair and cloak wound tightly round her, down the wind came Summer.

"Such a night I have had!" she cried laughing. "The winds and waves were having a dance, and you would never believe how wild they can get! Why, even the seals had to lie up in the caves, and the gulls were so frightened that they all went off inland."

"Were you dancing too?" asked Popsi.

"Of course I was! I like to be in everything. But I just came to warn you that the sea is still romping about, and you

won't be able to bathe to-day, or even paddle over the rocks."

"Oh!" wailed all the children. "What can we do, then?"

"I thought, if you liked, I would take you up to the moor for a change. If you run in now and have your breakfast I will just tidy myself a bit."

Before long they were all climbing the hills, toiling up and up till they came out on the wild moors, where rocks and heather stretched away to the skyline.

Photo: G. A. Booth.

The Curlew is a bird of the lonely moorland places.

Besides themselves there were few living things to be seen, only two curlew in the distance, and overhead a meadow pipit crying ecstatically his little note—*Please — please — please, please please please,* as he dropped plumb from the sky and then sailed out upon the wing again. But of flowers there was a blaze of purple heather, intermixed with the gold of the ground gorse. As they came over the shoulder of a hill they saw a spangle of white in the hollow before them.

"Let's go and see what it is!" said Topsy, starting to run down the slope.

"Be careful!" cried Summer. "Whenever you see that tasselly cotton-grass there is sure to be bog, and you never know how deep these bog-pools are."

"O-oh!" said Popsi, splashing out; "but it's rather fun, squelching about in it! And oh! Do look at this little red sort of moss."

She picked up a plant with tiny round leaves, each studded with hairs like the rays of a rising sun, and each hair hung with a tiny crystal drop.

Summer came nearer to look. "Yes, you've found the

sundew," she said, "or fly-trap, it is called sometimes. Do you see all those little flies and midges caught in the centre?"

"Does it catch them?" asked Topsy. "How?"

"The hairs are so sensitive that when they feel the touch of a fly they curl in on it like hundreds of little fingers. It is one of the plants that live on flesh, instead of getting their food only from the earth and air and water."

"What a horrid plant!" said Popsi, throwing it away. "I don't think I like it at all!"

"Well, it has quite a good reason for eating flies," said Summer. "You see, long ago when plants began to overcrowd each other, they had to think out all sorts of devices for getting enough food. Some of them, instead of fighting and pushing for room on the good land took to living in the marshes. But there the earth is sour from being always soaked in water, and has very little of the food that ordinary plants need, so they had to find some other kind of food to make up for it. That is why some of them took to eating flies, and why the sundew invented these sensitive hairs to catch them with."

"It is very clever of it," said Popsi. "But I think it is a horrid plant, all the same!"

"And you quite forget, I suppose, that there are little girls who eat rabbits and birds and animals—and consider themselves quite good, kind little girls too! No—we should all be in a terrible pickle if one kind of creature did not eat other kinds; the world would get so full that there would be no room for any of them to live at all. As it is, any creature that becomes lazy or careless or ill is instantly gobbled up; and that is why among the wild things you will never see any that are not perfectly fit and well."

"Well," said Popsi, shaking her head, "I suppose it can't be helped, but I do think if I were Mother Nature I would manage better!"

But Summer only laughed, and took them on over the hills.

Photo: E. Step, F.L.S.

The Sundew is one of the plants that live on flesh, instead of getting food only from the earth, air and water.

BLUE TIT.

From a Coloured Photograph by Janet Hewson.

Photo: A. H. Hall.

In the clear waters of a typical Chalk Stream, overhung with alder and willow, we get no peaty spates, no muddy floods to hide the gravel bed with its many-hued green weeds and abundance of fish life.

20.—THE FLORA OF THE CHALK STREAM

By A. H. HALL

IN the south of England, especially in Hampshire, Wiltshire and Dorsetshire, many of the rivers run through valleys of chalk, and are known by the generic name of "chalk streams."

The waters, in fishing parlance, are "gin clear," and unlike the heavy rivers of the midlands and the fast-running moorland streams, do not take on the colour of the contiguous land after rain; we get no peaty spates, no muddy floods—it requires prolonged and heavy rain, or a torrential downfall, to cloud these limpid waters for even a few hours and hide the gravelly bed with its wealth of many-hued green weeds, and the abundance of fish life, from the observer's sight.

If one were asked what were the predominant features of these valleys, the reply might well be, peace, luxuriance, and breeze.

In no part of our country is it possible to find more tranquil conditions. Most of the land adjoining the streams is devoted to grazing, and as one wanders through the meadows and watches the cattle browsing, or standing motionless in the midsummer heat with their bodies immersed

in the cooling waters, existence seems peaceful and easy ; even the everyday round of toil on the tilled lands is far enough away to cause no jarring note.

The pasture land is intersected with many ditches, or " drawns " as they are called in Wiltshire (the men, whose duties are to control the irrigation of these fields, being called " drowners "), consequently the land does not lack moisture, and the growth of the foliage is often astonishing.

Many of these valleys are narrow, the land sloping upwards only a short distance from the rivers, and the types of plants common to dry and somewhat barren chalk downs are found close to the luxuriant growth associated with the water meadows.

There are comparatively few stretches on an average stream which are densely wooded down to the water's edge, though one comes across dense withy beds, the stronghold of the persecuted otter, and patches of willows which grow to an enormous size. After midsummer the undergrowth renders these almost impenetrable thickets the favourite haunts of grass snakes, which may occasionally be seen swimming across the stream ; in winter, some of the jungles, and more commonly than is supposed, furnish cover for bitterns. Though the other trees are often a little distance from the banks they form a prominent feature of the landscape, huge elms with their broken contours, rows of tall poplars, and ash trees being characteristic—though the last-named rarely attain any remarkable size.

Photo: A. H. Hall.

Tranquillity and luxuriance are the dominant features of the Chalk Stream and its adjacent meadow lands, along which trees form a prominent feature of the landscape.

It may be fancy, but in these valleys it seems to be the rarest occurrence to get a windless period of more than a few minutes ; perhaps this feature has been exaggerated in one's mind by the almost ceaseless movement of the poplars, accentuated by the fly-fisherman's perennial excuse for bad casting, though the fact remains that a photographer, with neither of these reasons in his mind, will find still periods few and far between.

A ramble along the banks at any time of

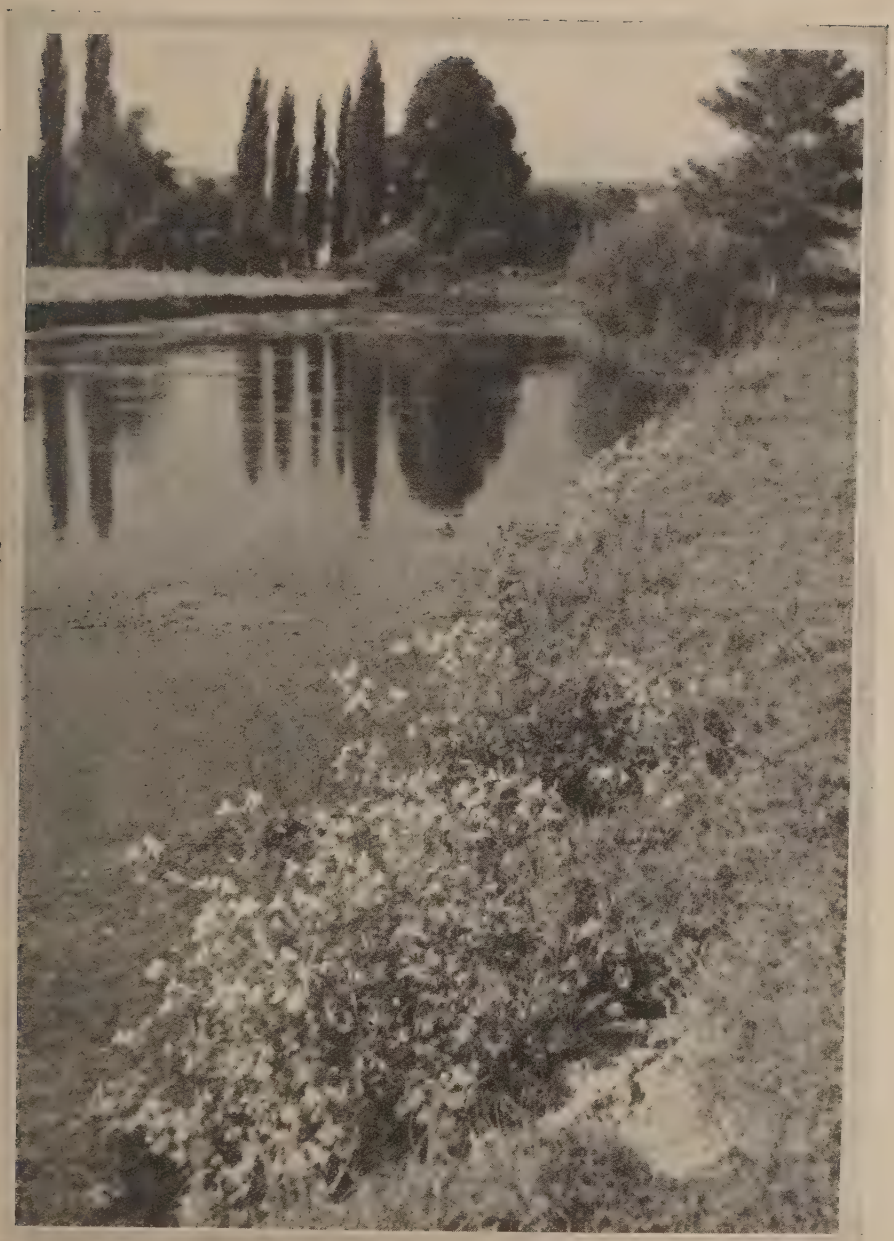


Photo: A. H. Hall.

MIMULUS IN FLOWER.

Though probably not indigenous this plant is finding a continually extending place along the southern Chalk Streams. With its golden trumpets it makes a handsome display.

spring or summer will reveal a wealth of colour in the flowers which perhaps reaches its zenith at midsummer, or shortly afterwards.

Whatever time is chosen, it will be seen that the prevailing tints are yellow and red, blue being comparatively uncommon; of course, the forget-me-not abounds, but not in sufficient masses to colour the scene; and in well-drained banks where these abut the stream the tender mauve of the scabious, contrasting with the white and yellow of the oxeye daisies which flourish in similar conditions, gives splashes of colour not to be seen in the flat meadows.

Photo: Benjamin Hanley.

The Marsh Marigold is becoming more local in distribution. Formerly common among the flora of the chalk streams, its place is being taken by the Mimulus.

In favoured spots this flower grows to a size comparable with the cultivated varieties, but the author's efforts to grow this biennial from seed in a suburban garden have failed, though the white variety of the knapweed, which is occasionally found here, flourishes under cultivation.

Marked changes in the chalk stream best known to the author have taken place in the last few years. The ubiquitous poppy, common in the nearest cornfields, has extended its range, and now blooms at the water's edge, and seemingly revels in the situation, though, of course, the spots where it is found are well drained.

The marsh marigold on the other hand, once common, is becoming more local, and its place is being usurped by the mimulus, a plant which is probably not indigenous. This change is an added source of pleasure to a ramble, as the mimulus is quite as handsome as the marsh marigold and less formal, and its golden yellow trumpets are of a form which is unusual amongst British wild flowers.

It is usual to find this plant growing in shady ditches near the stream, but since it has recently invaded the river its preference appears to be for a situation in full sunlight.

Another of the most noticeable flowers of the waterside is the meadowsweet, whose cream-coloured woolly heads are conspicuous at a distance. The dark red stalk is particularly tough, and as it grows rather higher than the surrounding herbage it often catches the angler's cast. This plant and the ragworts with their branching wiry stems, common as they are in such situations, are responsible for more lost tackle than the wily trout.

If the wanderer walking quietly near the river by patches of meadowsweet hears the songs of such familiar birds as the great tit, the starling, thrush, or reed warbler proceeding from the undergrowth, it is worth searching the clumps, as this plant provides a favourite nesting place for the marsh warbler, a great mimic of other birds, while it is probably much less rare than is commonly supposed. Unquestionably, many nests are thought by superficial observers to be those of the reed warbler, though the loops attaching the nest to the growths supporting it, and the blue ground-colour of the eggs with their ashen markings, are distinctive.

Two of the handsomest flowers to be

Photo: A. H. Hall.

POPLARS BY A CHALK STREAM.

Rows of tall Poplars are characteristic of the tree-growth by the riversides.

found by the stream are the giant willow herb and the hemp agrimony, both of which are plentiful and flower in profusion.

It is a matter for some surprise how little of the foliage near the banks appears to have been attacked by caterpillars, though farther back their ravages are often apparent. It may be that the author, who does not profess special knowledge of insects, may be inexpert at finding them, but in many years' wandering beside these streams looking at the birds, and generally keeping his eyes open for anything of interest, he can only recall one incident of any note when a colony of great elephant hawk moth larvæ was found on a clump of willow herb.

As a background to these flowers, and mingling with them, are the varying shades of green of the sedges, the yellow-green swords of the flags, the grey-green of the reeds, and more rarely of the giant reed mace, usually but incorrectly called the bulrush.

Though these streams are usually too well weeded by the water keepers, who look after the fishing, for most of the aquatic plants to reach maturity, they grow at such a pace that there will always be clumps above the surface of the water, some showing their flowers, and incidentally affording sufficient support for the beautiful yellow wagtail to settle on the surface and dart hither and thither in his efforts to catch the duns and spinners when a hatch of fly is in progress.

Unfortunately the American weed, which has all the vices of an undesirable alien, and none of the virtues of a respected colonist, is in many places swamping the indigenous weeds, and seems almost impossible to eradicate.

Leaving the river, the path to the road leads through drier meadows, and the character of the flowers at once change; most noticeable will be the clumps of lesser bindweed recumbent on the ground, the yellow toadflax, so like a small antirrhinum, and the small heartsease, or pansy, common enough elsewhere, but flourishing amazingly on the dry, chalky land.

Photo: A. H. Hall.

Elms, lifting high their broken contours, contrast strongly with the grey-toned Willows.

Photo: C. Clarke Nuttall, B.Sc.

Though the flowers on all the White Campion plants *look* alike at first glance, on some plants they are male, and on others female; and the plants always keep to the same sex. The above are flowers from a female plant. Note the five receptive columns projecting from the flower shown in profile on the extreme left.

21.—SEX AND THE FLOWER

By G. CLARKE NUTTALL, B.Sc.

THE question of sex as it relates to the ordinary flowers of the countryside seems, on the face of it, to be quite simple, but, like all questions of sex, it is not so simple as it appears, and there are all manner of unexpected problems and curious intricacies mixed up with it. In the article "Sex and Tree Flowers," on page 416 of the PAGEANT OF NATURE, sex as it affects the flowering of the common trees of our countryside was dealt with; here we propose to turn to some of our ordinary wayside flowers and to consider them also from this point of view.

As was said in the previous article, the perfect typical flower, such as the buttercup or the poppy, consists of stamens whose heads contain pollen, which is the male fertilizing element, and ovules enclosed in a case with a receptive apparatus at top, which represent the female element. In theory the pollen falls on the receptive column and, passing down it, merges with the ovules, and the fused contents become the seed which is the potential plant of the next generation. Could anything be simpler?

But an apple of discord, or rather a nucleus of deep complications, was introduced into the matter when Nature showed a preference for—one cannot say a compulsory insistence on—the male element being brought in from another flower, and not out of the stamens of the same flower which produces the ovules. At any rate, it would seem that an occasional cross is almost vital to Nature's plans if the strain is to be kept up to the level, and as if the simplest way for new forms to arise was the intermingling of sex elements which have come from different parents. So to meet this requisition we have a long series of happenings in flowers which remind us of the commutation and permutation sums of our schooldays where, given certain sets of conditions, one reckoned how many

different arrangements of those conditions it was possible to make—no mean number where the problem of sex and the flower is concerned.

At one end of this series is the complete flower like the buttercup, at the other end will be found that the male flower-clusters all lie on one set of plants and the female heads all on another set. They have really no connexion one with another.

Between these two extremes all sorts of intermediate expedients are found, and often

Photo: G. Clarke Nuttall, B.Sc.

The male (*a*) and female (*b*) flowers of the Hop are always on different plants.

is the unisexual plant which bears flowers enclosing only male organs, or flowers including only female organs. These plants are permanently male or female, they never vary in the sex of the flowers they produce. The hop is, perhaps, one of the most striking examples among wayside plants. Its stems, creeping and twining over the hedges, produce small yellowish-green clusters of male flowers and larger globular heads of female flowers, and though these seem mixed together when they are growing, yet if one takes the individual stems and traces their course back to the ground, it the fact that they are intermediate is entirely unsuspected. Plants are extraordinarily deceptive in this matter. For instance, in some cases though all their flowers *look* alike, one finds when one investigates them closely that while some may be complete, others just like them on the same plant have really only male or female parts that are functioning. Thus among the apparently perfect flowers of the shining geranium, whose pinkness decks some of our waste places, there are some which have no anthers to the stamens, and hence no pollen, so that these are merely female

flowers, and the seed that is produced from them must necessarily be the result of a fertilization from another flower. Thus does Nature in this plant ensure that her preference shall be carried out.

Then take that most interesting relative of the docks, the bistort, one of the strongest vegetable astringents, the "polygony" of which Spenser wrote:

"Then whether it divine tobacco were,
Or panachoea or polygony,
She found and brought it to the patient deare
Who all this while lay bleeding out his hart-blood neare."

In its crowded spikes of small blossoms the flowers are set in pairs, of which one is perfect and the other only a male flower (though one would not think it), because, while its eight stamens are flourishing enough, its seed-case is just a pretence and contains no good ovules. The perfect flowers come out first, and as they usually have very many visitors, no doubt they get plenty of pollen from outside brought to them; but, just as they are withering, the second flower of each pair opens, pushes boldly out its stamens and from the pollen fertilizes its twin, if by any chance it has remained unfertilized. In these two cases, then, the pretence-perfect flower is in one instance only female, and in the other only male.

Other plants, however, make no pretence in the matter, and while bearing some perfect flowers produce simple unisexual flowers in addition. One sees this in great numbers of flowers of the daisy clan. The yellow centre of the daisy bloom is a massed collection of little tube-like flowers containing both male and female parts, but the white rays that form a halo to the centre have each only a seed-case containing a seed. There is no vestige of a stamen about them. Then, again, in quite a number of the plants whose tiny blossoms are arranged in big flat clusters—everyone knows the cow parsley and its common allies of the hedgerow—some flowers carry male and female organs and others only male organs. In the bur-chervil the perfect flowers surround imperfect ones which possess merely stamens and show no hint of any seed apparatus. In the hedge parsley itself the central little groups of each big cluster of flowers are all male flowers, while the other groups are usually made up of two perfect flowers and several male flowers which, however, closely resemble perfect flowers in appearance. The little dainty wood sanicle of the woodlands and those commonest of weeds the

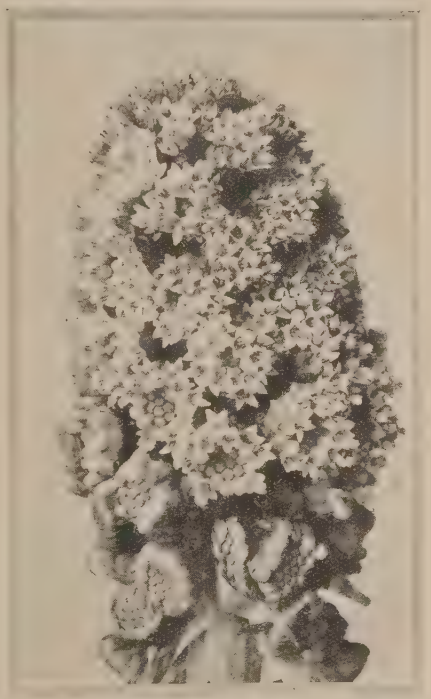


Photo: G. Clarke Nuttall, B.Sc.

A "Bog-horn"—the flowering spike of the Butter-bur (*Petasites*). Some of these spikes carry male flowers, with possibly a few females among them; others carry female flowers, with possibly a few males in the centre of each group.

chervils in general, must also be included in this class. The former usually has three perfect flowers in each ball or "umbel" with eight to ten male flowers round them like a wreath.

Further, there are many plants that produce no perfect flowers at all, though they make a pretence of doing so. These bear flowers that are frankly either male or female, and also other flowers that pretend from their appearance to be perfect, but are really only of one sex because the opposite sex-part is a sham. Look at those most curious and

After flowering, in both the Bur-reed and the Bulrush, the male flowers fall off, leaving the upper part of the spike bare, but the female flowers remain, increase in size, and form fruit.

handsome pinkish spikes of flowers that the country folk call "bog-horns," which push up sometimes a foot high in early spring out of swampy meadow-land or wet ditch sides from the roots of the butter-bur. These horns differ somewhat among themselves, some being larger and denser than others, but each has a thick fleshy axis on which is arranged on very short stalks a number of slightly hollow heads of small florets. There may be fifty of these heads on an axis and fifty small florets to each head, which gives the not inconsiderable number of 2,500 flowers to a spike, though these numbers vary. If we look at one of the smaller loose spikes, we find in each head a quantity of little flowers, each with its pink petals joined bell-like and containing a large quantity of honey, and five stamens, their magenta heads all united into a ring. Inside is a seed-case certainly, but there is no seed in it, and it has no apparatus to receive pollen, which obviously it does not want. Around these flowers, which are, of course, male in nature, there may be found a few others with a thread-like circle of petals enclosing a perfectly good ovary topped by a receptive column, but with no sign of stamens and, incidentally, no honey; these supply the female element. On the thicker, denser spikes we find just the opposite state of affairs. The heads are almost entirely composed of the female flowers, with here and there in the centre of the head the sham-perfect male flowers.

Because of its flesh-like appearance the "bog-horn" attracts all sorts of flies and creeping insects, and these, as well as bees, form willing carriers of pollen between the spikes, and, in any case, each spike supplies a modicum of the sex opposite to that of which it chiefly consists. In the same class are the coltsfoot and the marigold, for in these heads—so like in structure to that of the daisy, while the rays are female flowers only—the central tubular florets are not complete as they are in the daisy, but are

Photos: G. Clarke Nuttall, B.Sc.

Male (*a*) and female (*b*) flowers of the Bur-reed (*Sparganium*).

Photo: G. Clarke Nuttall, B.Sc.

A is the male flower of the White Campion. It contains stamens only; *a* are the stamens removed from the flower. B is the female flower containing seed-case and five receptive columns (shown isolated at *b*). The white dots at the base of the seed-case are rudimentary stamens.

of the male sex only, because the female organs have aborted.

But still our "commutations and permutations" go on, and next we have to reckon with those plants which act in an open downright way, and have nothing whatever to do with completeness. They produce plain flowers of the male sex and plain flowers of the female sex, often quite different in appearance. In that interesting plant the bur-reed or *Sparganium*, which grows abundantly around ponds and along stream sides, the flowers are arranged in rounded heads on the stems. At the top of the stem the heads are about the size of a pea and consist entirely of stamens and bracts—male flowers in a somewhat rudimentary form—while lower down are larger heads built up of very simple female flowers, each just a seed-case surrounded by several scales. Again, the big bulrush spike, like a poker with rather a fat head which may be nearly a foot long, has massed at the upper part great numbers of little male flowers pushing out yellow stamen heads, while the lower part of the head is taken up by female flowers which are minute seed-cases snugly wrapt in soft brown hairs. When flowering ends, the division between the sexes becomes very marked, for the male flowers wither and drop off, leaving the top of the spike quite bare, while the female flowers hang on and, increasing in size, cause the lower part of the spike to be thicker than ever. The small stinging nettle, too, comes into this class, for it always carries its two sets of flowers of opposite sex on the same plant, while curiously enough the common nettle belongs to those very exclusive and thorough individuals which place the sexes on different plants.

So far all the plants we have discussed bear not more than two kinds of flowers, though there may be very varied play upon the sex elements; but there are a few plants which bear three kinds of flowers at the same time, namely, perfect flowers

Photo: G. Clarke Nuttall, B.Sc.

In the Grape Hyacinth the smaller pale-blue flowers at the top are neuter in sex, containing neither male nor female organs. In the other flowers we get gradation from perfect flowers to flowers entirely unisexual.

and imperfect flowers, of which some are male and others female—the burnets, for instance, both salad and great, though in the latter the flowers are mostly unisexual ; the common dock, the little rue-leaved saxifrage, and the uninteresting wall pellitory. In the last named, however, the complete flowers are said rarely to form seed.

Photo : Benjamin Hawey.

The Common Nettle belongs to those very exclusive and thorough individuals which, like the hop, place the sexes as far apart as possible, that is, on different plants.

Some species of plants ring the changes not only upon the same plant but upon different ones. The red campion is a splendid example of the point in question. At first sight all the flowers of all the plants look alike, but cut down and open a number of them taken from different individuals, noting carefully to which plant each belongs, and one finds some of the flowers with ten splendid upstanding stamens, with only a minute white knob to represent the female side of life ; while others *taken from different plants* have a bold, green seed-case full of ovules and topped with five tall, well-developed receptive columns, but as for their stamens they are dwarf, impotent dummies cringing at the base of the seed-case. The white campion is like its red brother in this matter. No doubt both sets of flowers started as perfect flowers, but Nature's preference for cross-fertilization has been here made a definite order of things in this manner. Occasionally one finds a complete flower where the stamens with fully developed purplish heads stand in a ring round a perfect seed apparatus, but this is unusual.

Again, some plants carry complete flowers while other plants of the same species only carry incomplete flowers, either male or female, but not both. This happens in the field scabious, in marjoram, mint, thyme and the night-flowering campion. Other plants complicate matters still further by having three kinds of flowers—perfect, male, and female—each carried by separate plants which never vary the kind of flower they produce. This is found in the Nottingham catch-fly, the dwarf catch-fly, some saxifrages, and occasionally in the white campion. And so we come to the other end of the long series where we have the sexes quite distinct upon separate plants. We have travelled from the buttercup and the wall-flower to the hop and the hemp and the ugly little dog's mercury. In all unisexual flowers cross-fertilization is inevitable, and upon the widest possible basis. It is rather a curious point that these flowers, as a rule, lack colour, scent and attractiveness.

Dwellers in Shells

2.—THE EDIBLE SNAIL

By T. RUSSELL GODDARD, F.L.S.

THE edible snail is not so well known by sight as the common garden species, owing to its restricted range in Great Britain. However, most people know it by name and reputation. It is also sometimes called the Roman snail, under the mistaken impression that it was first imported into this country by the Romans. The fact that quantities of the shells of this species have been found with Roman remains when excavating the sites of their camps, etc., has lent colour to this belief. It has been definitely proved, however, that the edible snail was an inhabitant of Great Britain long before the Roman invasion. Furthermore, it is now generally considered to be a native of this country. Another unfortunate name which has been applied to the edible snail is the apple snail. This error was probably due to a misinterpretation of its scientific name, *Helix pomatia*. The specific name is not derived from the Latin *pomum*, an apple, but from the Greek πωμα, a cover, on account of the creature's habit of secreting a thick cretaceous "plate" across the opening of its shell preparatory to hibernation.

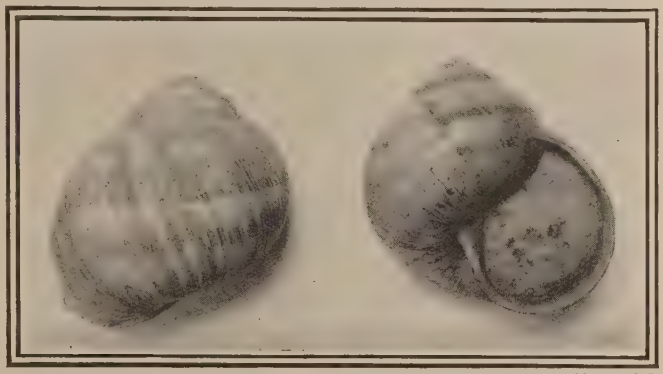


Photo: T. Russell Goddard, F.L.S.

The Edible Snail (*Helix pomatia*) is the largest of the British land species. The shell is pale yellow or white in its ground colour, and is covered with a horn-coloured epidermis which is liable to become rubbed off.

The edible snail is the largest of our British terrestrial species, and is so distinct that it is impossible to confound it with any other of our native snails. It is bulky and usually pale yellowish-grey or cream in colour, and the whole of the body with the exception of the under surface of the foot is covered with prominent tubercles. The upper tentacles are long, and the eyes, which contain a crystalline lens and a retina, are placed near the tips. The foot is broad, and surrounded by a pronounced fringe. The shell, which is roughly globular in shape, is thick, solid and opaque, and the spire consists of five whorls. The ground colour of the shell is pale yellow or white, with usually three or four, and occasionally five, somewhat indistinct brown bands. The whole of the shell is covered with a horn-coloured epidermis which is very liable to become rubbed off. The surface of the shell is coarsely ridged with the lines of growth.

Variation in this species is chiefly confined to the shape, size and thickness of the shell. A variety occasionally found on the Continent in which the shell is enormously thickened has been named *ponderosa*. In

When starting on a journey the Edible Snail first protrudes its body-foot, which is in one piece; then follows—

the case of one example the shell weighed 400 grains as against an average of about 90 grains in the type. Sinistral or left-handed monstrosities have occurred in Kent and Surrey, and specimens in which the whorls are disconnected are known, but these are distinctly rare. A certain amount of variation in the depth of colour of the shell and the banding occurs. This is largely influenced by the nature of the

Photos: John J. Ward, F.E.S.

—its head, bearing its upper and lower pairs of feelers. The feelers are projected like the introverted finger of a glove, and—

—the eyes appear on the tips of the upper pair when fully extended. It then opens its huge mouth, in which is a rasp-like tongue, bearing over twenty-one thousand teeth.

locality; specimens from wooded mountain slopes are usually more richly coloured and banded than those from the open plains.

The edible snail is a central European species, its range extending from south-eastern Russia into eastern France, and from Denmark and southern Scandinavia in the north, to the Balkan Peninsula in the south. In Great Britain it is distributed throughout that part of the country

Photos: John J. Ward, F.E.S.

Thus prepared for action, it gracefully glides, with its house on its back, to its feeding-ground.

lying east of a line drawn from the Wash to the Bristol Channel. It is absent from Devon and Cornwall. Its remains have been found in the neolithic deposits in this country, and in the later pleistocene and the pliocene beds on the Continent.

The edible snail, unlike the common garden species, seldom climbs trees or walls to any great extent, but prefers to remain upon the ground. It frequents woods, hedges, low stone walls, and uncultivated places generally. However, on the Continent it often exhibits a preference for gardens, fields, and vineyards. In some parts of northern France it simply swarms in the laburnum woods. It has been found living in pine forests up to 5,000 feet above the sea-level. Although preferring a calcareous soil it frequently occurs in sandy districts. This species is not nearly so destructive in gardens as the common garden snail, as it usually prefers decaying vegetation. Its taste in food is catholic—cabbage, lettuce, vine, nettle, dock, laburnum, aromatic herbs, fallen fruit and fungi are devoured with equal avidity.

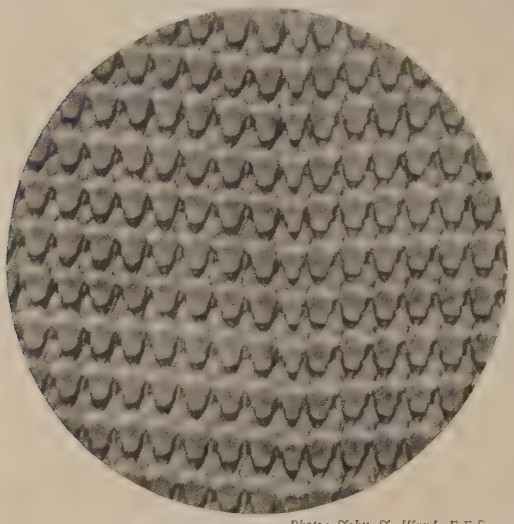


Photo: John J. Ward, F.E.S.

Some of the twenty-one thousand odd teeth on the lingual ribbon of the Edible Snail. (× 150.)

Upon the approach of autumn the edible snail sets about seeking suitable winter quarters. As a rule it burrows several inches into the ground, but occasionally hibernates beneath dead leaves or moss. A thick, chalky film or epiphragm is secreted, and this exactly fits the aperture of the shell. Within this a thin membranous one is formed. The outer epiphragm fits so accurately that hibernating specimens have been immersed in seawater for a period of three weeks without coming to any harm. Awakening from hibernation usually takes place in April or May. In addition to hibernation, the edible snail sometimes protects itself from desiccation during hot dry weather by again retiring a few inches into the ground and sealing up its shell with a solid epiphragm.

The chief interest of the edible snail lies in the fact of its having been used as food by man at various periods of the world's history. There is no doubt that prehistoric man found this species, together with many other terrestrial snails, a handy and easily obtained means of sustenance. The finding of large quantities of their shells in his habitations bears witness to this fact. The Romans, too, made use of this species as an article of diet in various parts of their empire.

Farms upon which the edible snail is bred and cultivated for food are still numerous on the Continent, especially in France and Germany. Paris alone is said to consume fifty tons daily during the season. The taste for snails is also becoming developed in this country, for just before the war 100,000 specimens were imported into London for food purposes every year. Large quantities are also imported into New York and other places in America. These supplies come mainly from France, and the demand is annually increasing. A fear that the species might soon become extinct led the authorities of the Department of the Côte d'Or, France, in 1908 to establish a close season, and place the edible snail under the protection of the game laws. For the sake of those readers who are tempted to sample a snail diet themselves, it may be well to add that hibernating specimens with the epiphragm intact are the most suitable.

Strange Facts of Fish Life

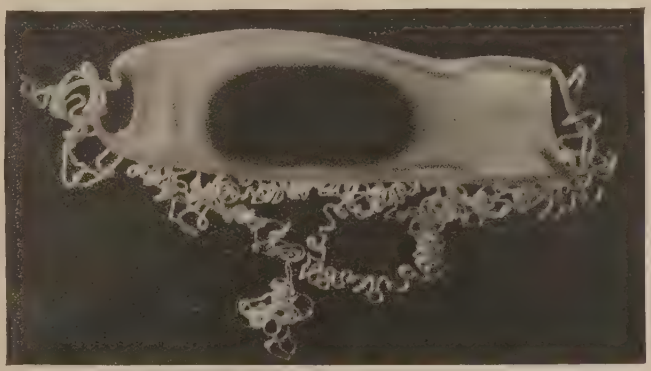
7.—THE EGGS OF FISH

By DR. FRANCIS WARD, F.Z.S.

With photographs by the Author

THERE are two large groups of fish—those that have a cartilaginous or gristly skeleton and those that have a skeleton of bone.

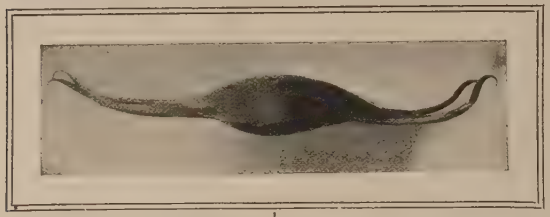
To the first group belong sharks, dog-fish, skates and rays: in many of this group the young are born alive, but the smaller members of the group deposit an egg. This egg is analogous in its structure to the egg of a bird, except that it has a horny instead of a chalky shell, which is better described as an egg-case. The black, crinkled egg-case of the dog-fish or ray may often be found along the seashore. It is open, for the young fish has escaped from it in the sea, and the egg-case, in time, having broken from its moorings, is washed up on to the beach.



Egg of Dog-fish with the yolk showing in the centre, and the tendrils by which it is attached at each corner.

The newly expressed egg of the dog-fish has a very different appearance from that of the case picked up on the shore. It is of a delicate greenish-yellow hue; in the centre is a large yolk, which can be seen clearly defined when it is held up against a strong light. The case is flattened, with a slight swelling in the centre for the yolk; it is quadrangular in shape, and to the four corners are attached tendrils. The tendrils are comparatively thick at the base, but gradually taper off to a fine point. They are like crinkled-up watch-springs, and can be pulled out to the extent of a yard. When let loose they fly back into the positions as shown in the illustration of a recently deposited egg of a dog-fish.

The young dog-fish takes from seven to ten months to hatch, and if it were not that the case was safely secured during this time, it would be washed ashore and the embryo perish. The egg is, therefore, fixed by means of the four sets of tendrils. When the time arrives for the case to be fixed, the tendrils at one end extrude from the female; she then swims round a stump or seaweed stem, scraping herself against it as she goes round, until the extruding ends of the tendrils catch hold. The fish now continues to swim round and round until the tendrils are wrapped round the stake or stem. The egg is next pulled out, but the dog-fish continues to swim round, and the tendrils at the other end of the case are wrapped over the stem in a similar manner. These tendrils, as I have said, are like crinkled springs, and those wrapped over the case itself easily expand with the increase in size of the developing embryo.



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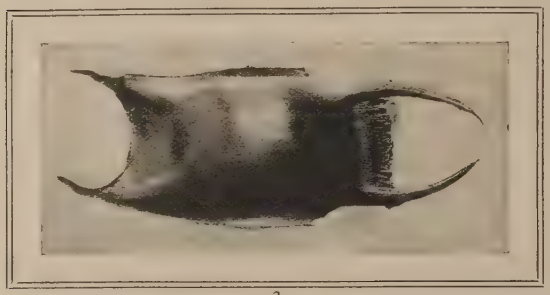

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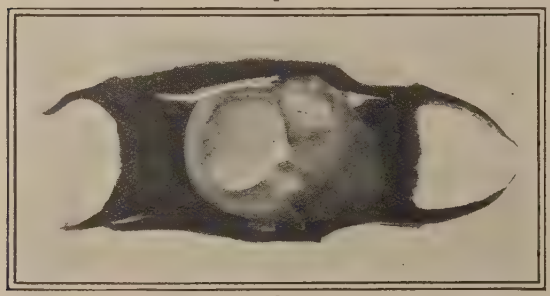

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(1) Side view of the egg of a Ray, showing hooklets with which it takes a temporary hold until fixed; (2) Full view of the egg of a Ray ready to hatch. The embryo is filling up the whole case; (3) The same egg-case opened to show how the embryo is packed in, just before hatching.

The egg-cases of skates and rays are similar in structure to those of the dog-fish, with the difference that the long fixing tendrils are replaced by sharp-pointed hooklets, which take a temporary hold until the seaweed growing over the case prevents its being carried hither and thither by the tide.

Just before a ray is hatched, if an egg-case is opened, it will be seen how the embryo is packed up inside it, so as to fill up the case entirely.

Next turning to fish that have bony skeletons. In home waters the viviparous blenny alone has the young born alive.

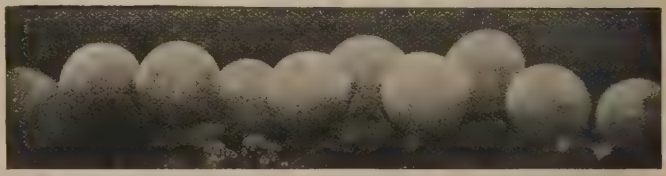
Among cartilaginous fish that have young, only one at a time is born; but I have counted 150 in the blenny just as the young fish were ready to escape. These I released into the sea and they swam merrily away.

The egg of a bony fish is globular in shape, and consists of a large yolk encased in a delicate egg membrane.

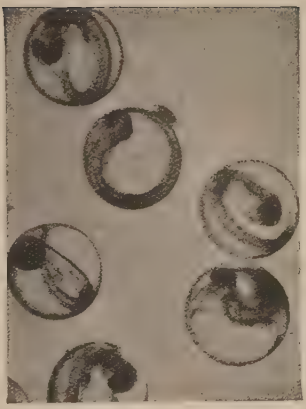
There are two distinct types of egg in this group of fishes, those that are heavier than water and sink, and those that are lighter than water and float on the surface.

To begin with a description of eggs that are heavier than water, some are quite free, like the eggs of the salmon family. These eggs have a glistening, shining surface and are protected by being buried in the gravel, as has already been explained in a preceding article (page 403). With all other freshwater fish, most shore fish, and a few deep-sea fish, these heavy eggs are sticky when first shed, and become attached to rocks, stones, shells, weeds and to each other. As an illustration I have shown clusters of roach eggs attached to submerged roots. These can be found in most ponds of any size in the spring.

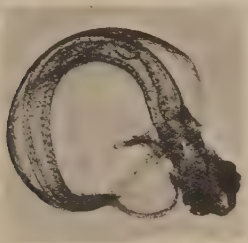
At other times eggs of this type are attached singly, as illustrated by the egg of a carp. Here it will be seen that the embryo is ready to hatch. The eyes of



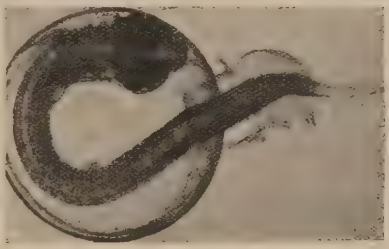
Heavy eggs of the Salmon unattached to each other. (× 4.)



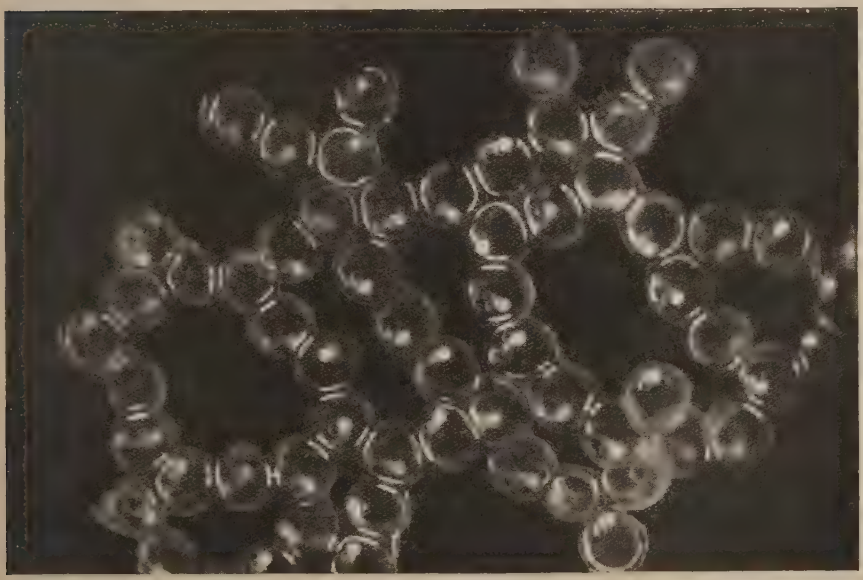
(Left) Clusters of the heavy eggs of the Roach attached to submerged roots. (× 2.) (Centre) Egg of Carp with embryo just ready to hatch. (× 8.) (Right) Floating eggs of the Plaice. (× 8.)



Plaice hatching head first.



Plaice hatching tail first.



Heavy eggs of Perch, attached to each other in ribbons. The embryo Perch are ready to hatch. (× 6.)

this cyprinoid are parallel with the stem. The rounded light-coloured mass in the centre is the yolk-sac, around which is wrapped the fish.

Some eggs, like those of the perch, are attached to each other so as to form long glistening ribbons, which are deposited on submerged roots of the trees on the banks, and on sub-aquatic plants. During the perch spawning season the swans on the Thames may be seen eagerly devouring these newly deposited ova and straining their long necks to get down to the ribbons in mid-stream.

Floating Eggs

Turning our attention to floating eggs, these are only found in the sea; they are free, and from this type of egg are hatched almost all our marine food fishes.

Floating eggs are very small, the largest being that of the plaice, which is almost one-twelfth of an inch in diameter, the smallest that of the dab, which is less than one-twenty-fifth of an inch in diameter. Others, for example those of the sole, the cod, and the turbot, are of intermediate sizes. Though most of our food fishes hatch from floating eggs, herrings are an important exception.

Floating eggs are perfectly transparent before the embryo develops—undoubtedly a provision of Nature for their protection. If a number of plaice eggs are put in a tumbler of sea-water it is extremely difficult to detect them.

The specific gravity of floating eggs is just below that of sea-water. Those shown in an illustration of floating eggs of the plaice were touching one another; but while I was taking this microphotograph of the eggs, a copepod jumped on an egg, and the weight of this minute crustacean, which is shown magnified, scattered the eggs right and left.

The plaice, like the various other fish that have floating eggs, spawn on the sea bottom and the eggs come up to the top; these usually hatch in fourteen days. Sometimes the young fish hatches head first; in this case the embryo appears to take a fixed point with its tail, then alternately straightening and relaxing its back in quick succession, it hammers with its head and shoulders against the side of the rent where the head has come through. In this manner the membrane is torn open to allow of the escape of the hatching plaice. At other times the embyro hatches tail first, when progress is very slow.

Floating eggs when present are at certain times and in certain places found in enormous numbers. If a tow-net is used in February over cod breeding-grounds, a few perfectly transparent spherical globules, about one-twentieth of an inch in diameter, are found among the hundreds of other forms of minute marine life. By March these floating eggs of the cod have so greatly increased in numbers that they are more abundant than any other form of marine life found near the surface. So abundant do they become, that on a calm day they can be seen from a boat floating as a thick layer. By the end of May the sea swarms with myriads of transparent little cod, each about one-third of an inch long.

Floating eggs are present in the sea all the year round, but they are most abundant in the spring. The time that marine eggs take to hatch varies, as in the case of the eggs of freshwater fish, with the temperature of the water, and with individual fishes. The eggs of the anchovy usually hatch in two to three days, those of the sprat in three to four days; and it is exceptional for any of the eggs of our food fishes to take more than a fortnight.

Eggs of the Herring Family

The herring family consists of the herring itself, the sprat, pilchard, the shad and the anchovy. In this family we have examples of the three types of egg found among bony fishes. The eggs of the shad are heavy and free from each other, like those of the salmon. Those of the herring are heavy and adhesive, and are attached to stones, gravel and seaweed; while those of the sprat, pilchard and anchovy float, like those of the plaice and cod.

The herring and sprat often frequent brackish water, and herring frequently spawn in water sufficiently fresh to permit their eggs to be attached to the leaves of freshwater plants.

The number of eggs deposited by any particular fish is directly in proportion to the protection they receive and to the likelihood of their being fertilized. The ling merely sheds

On the dead eggs of freshwater fish a fungoid growth appears known as *byssus*. A Minnow's egg so attacked looks to the naked eye like a white woolly ball, but under the microscope it appears thus.

her eggs into the sea, and produces over half a million eggs to each pound weight of her body. The trout deposits about a thousand eggs to the same weight, for her eggs are partially protected by being buried in the gravel. The stickleback, though found in every pond, stream and lake, gathers but a mere seventy to eighty eggs into the protection of his nest ; while of eggs with horny cases only one or, at the most, two are deposited at a time. It stands to reason that when any particular species of fish deposits an enormous quantity of eggs, a great proportion of them must be destroyed, or that particular species would soon outnumber all other fishes.

When investigating the life history of the roach, I made the following count of eggs, which will enable the reader to appreciate the destruction that occurs amongst unprotected eggs. Along one side of a pond grew a row of poplar trees, and on the submerged roots of these trees the roach deposited their eggs. Measuring out fifty yards along the bank, with the assistance of two friends I gathered all the eggs in certain measured areas, and estimated that in the fifty yards there were approximately seven million five hundred thousand eggs. During the next four days a pair of ducks busily ate up all the eggs just below the surface of the water, shoals of young roach picked them off during the day, and both night and day big and little eels literally sucked the roots clean. In four days we again counted the eggs in similar areas, and estimated that in the place of over seven million a mere ten thousand were left. The same enormous destruction of eggs is the rule rather than the exception.

If an egg is unfertilized it soon dies, becoming white and opaque. On the dead egg of freshwater fish a fungoid growth appears known as byssus. To the naked eye the appearance of an egg attacked by byssus is that of a minute white woolly ball. The growth of this byssus is very rapid, and the last illustration will demonstrate the rapid growth of this fungus.

Byssus is different from fungus (*Saprolegnia ferax*). This pest to fish culture attacks the living eggs when their vitality is low, and when the conditions are uncleanly. At once the greatest care must be taken to remove any eggs attacked, or the whole batch will soon be affected.

The same egg nine hours after, showing the rapidity of the fungoid growth.

Photo: Stanley Crook.

Chicks of the Waterhen soon take to the water in response to the call of the parent birds.

47.—THE WATERHEN

By J. T. NEWMAN

WATERHEN would seem so suitable a name for this bird that one wonders why it should go so commonly under the name of " moorhen." The bird has many local names : for example, it is known as the marsh hen and moat hen—both appellations being more suitable than the commonly applied moorhen. For it has little to do with the moors. One can only conclude that the word is a corruption of " mere," for meres, marshes, ponds and streams are the haunts it loves, and so common is it in these places that one can hardly approach water in any part of England without hearing its short, unmistakable crooning call.

Yet the waterhen is an elusive creature. One may see them in the distance foraging on the banks of the stream or on low-lying ground, walking daintily and picking up seeds and insects. Apparently they are unaware of an intruder ; but watch closely, and one by one they will be seen to disappear, until by the time the observer arrives on the scene not one is in sight. Some will have taken cover in holes in the bank or amongst the reeds and water-weeds, and others will be practically under water, swimming silently with just enough beak above the surface to enable them to breathe. If detected they dive without making a ripple and, using their wings as propellers, travel swiftly out of danger. As they are not web-footed, the wings are of great assistance when diving and swimming under water, and should one start to fly it uses its feet

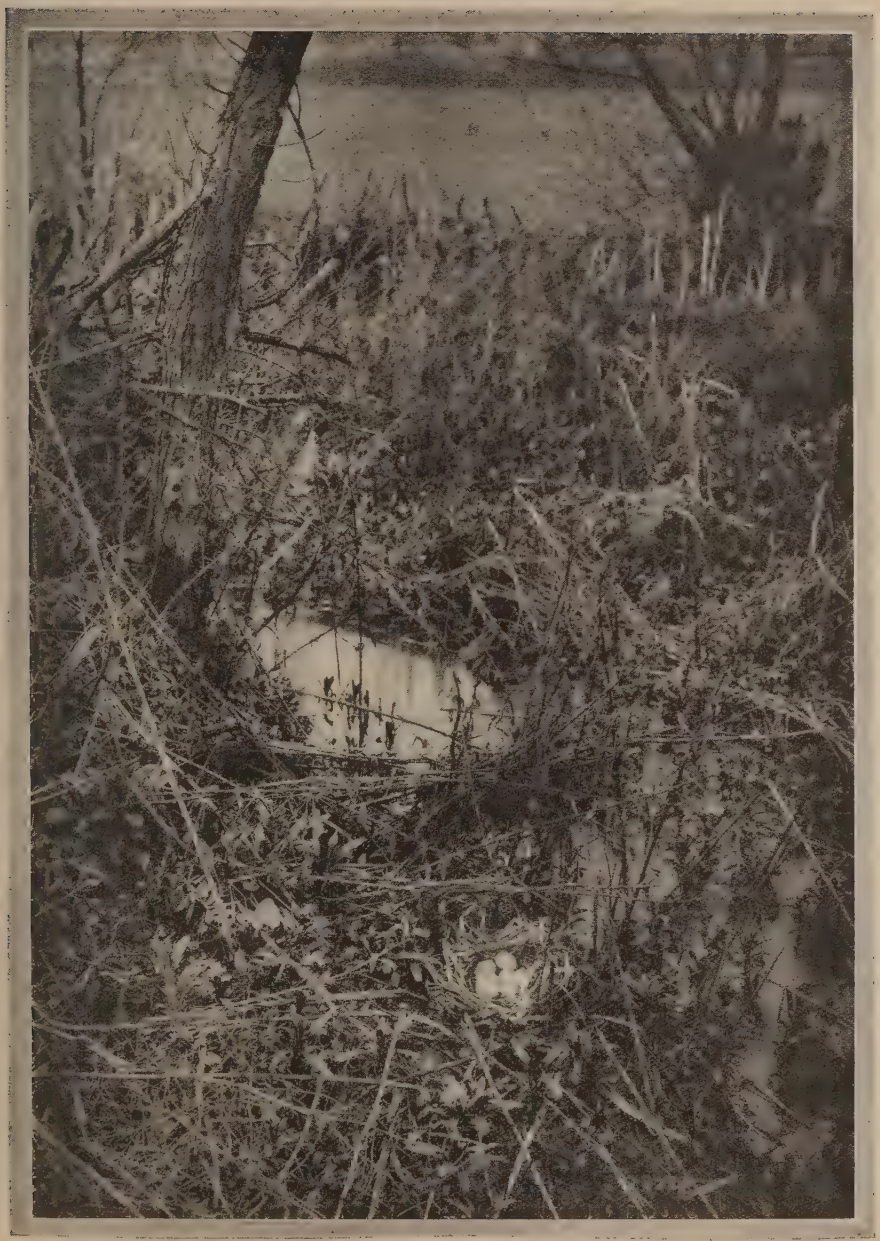


Photo: J. T. Newman.

AN IDEAL HAUNT OF THE WATERHEN.

Usually the nest is built on the ground among flags and rushes, as near the water as may be consistent with security.

Photo: Stanley Crook.

The Waterhen on the march picks its steps daintily while searching the ground for insects and seeds.

like paddles, skimming the water and leaving a long streak on the surface. The flight is low and short.

These birds seem to be very faithful to certain localities. For the last thirty years I have known them nest by a certain large moated castle. During the great drought of 1921, when the moat was so dry that one could walk over any part of it, they continued to frequent the place, but I discovered that they had access to water through a long culvert under a railway embankment, which led to a small river. During a hard frost, when their natural food was unobtainable and they were hard-pressed, they would come to feed with the domestic poultry.

At a distance the birds appear to be black and white only. When photographing them on the nest, at a distance of only a few feet, one is able to note the different shades in the plumage—brown and olive, with slate-grey on the throat and breast. Under the wings the feathers are white, while the tail, which is short, has under-coverts of white. The bill is greenish yellow with bright red running up into the forehead, a characteristic touch which is at its brightest at breeding time. The female is rather larger than the male, and, besides, is distinguished by brighter plumage than her mate. Altogether the birds looked very pretty as they sat on their nest in the furze-bush some distance above the waters of a small pond. They were very restless, however, constantly twisting round, and it was some hours before I could secure a front view; but I was rewarded for waiting, for two of the eggs hatched out the same day, and I photographed the chicks before they left the nest. That first day their heads were such a bright red that one might almost have thought they were bleeding. It was not long before they

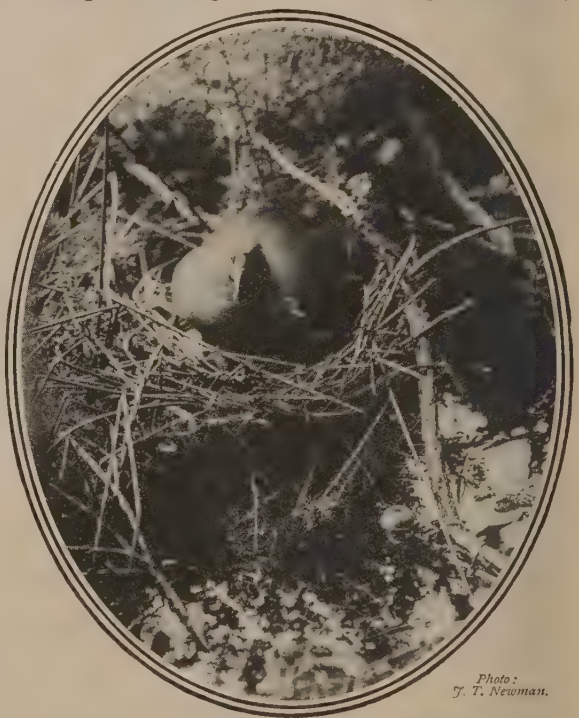


Photo: F. T. Newman.

The Waterhen will build its nest in bushes or trees if there is danger of rising water. This one is situated in a furze-bush.

Photo: F. T. Newman.

A good clutch of eggs of the Waterhen; the dark markings are well shown.

Photo: F. T. Newman.

Chicks of the Waterhen hatching out on a warm day. The youngsters were left to struggle out of the shells as best they could. Note the unwebbed feet.

slipped into the water in answer to the *chip-chip* of the male bird.

This particular brood was a very small one. I have seen many with eight or nine eggs, and once I photographed such a clutch in the act of hatching out. It was on a very warm day, and the parents had left the youngsters to struggle out of the shells by themselves. This they achieved successfully, and no sooner were they dry than they flopped off into the water and began bobbing about like corks, swimming and diving with the utmost ease.

Photo: F. T. Newman.

Nest and eggs of the Waterhen situated in a hawthorn bush five feet above the stream.

As a rule the nests are built on the ground amidst flags and rushes. I have photographed just such an ideal site by the side of a small stream in Buckinghamshire, where there were half a dozen nests within a small radius. Should the stream be in flood, however, the nest is built high up in some overhanging tree. The one shown in the photograph was five feet above the water. Doubtless the flood had subsided after the birds had constructed their nursery, and there it was left, high and dry in a hawthorn bush. If the water rises after they have begun to build, they will make great efforts to raise the structure above the flood—for a dry home they must have—piling it up in a feverish race against the water. Then, when the stream falls again, one may see it, a huge mass, perhaps two feet in height, conspicuous enough to attract the attention and provide a rich feast for carrion crows and thieves of all kinds.

The waterhen is resident and partially migratory. It cannot be classed as a very close sitter. Should it be disturbed by the approach of an intruder, the hen will slip quietly off the nest and place herself in hiding near by until the danger be withdrawn. When leaving the nest of her own accord the hen covers up the eggs with any material she may have at hand, but if driven off, the eggs are left exposed, and one can admire their rich colour—brownish grey with markings of dark umber or orange-brown. Eight or nine is a full clutch.

In addition to the nest proper, the waterhen builds several sham nests ; these are usually of slighter construction than the nest in which the eggs are laid. Examples of these spare nests are frequently found round a pond frequented by this bird. Apparently one use of the spare nests is, that after the young are hatched the mother will collect them on these just to dry their feathers and have a rest. Then, slipping off into the water, she calls her chicks together and they all swim off, making a pretty picture, each little creature bobbing its head in quaint imitation of the parents.

In a backwater of the River Bulbourne at Berkhamsted there is a colony which I have observed for many years ; the population does not appear to increase, which fact lends colour to the theory, that the old birds drive away the young at nesting time.

Photo: Henry Willford.

The Great Tit is a bird of extreme activity, full of life and energy. It nests in holes of trees or crevices of masonry.

48.—THE TITMOUSE FAMILY.—Part I
Great Tit, Coal Tit and Blue Tit

By FRANK BONNETT

THE titmice are a numerous family; some are very common, while others are comparatively rare or only to be met with in certain localities. For our present purpose they may be conveniently divided into two classes: firstly, those of the sociable kind (sociable, that is, from man's point of view), and secondly, those of more retiring habits, which are, as a rule, known only to those enterprising nature lovers who seek them in their own peculiar haunts. The former class includes such well-known species as the great tit, the coal tit and the blue (or "tom") tit. All these are common birds and seen by everybody, though not always readily distinguished the one from the other. The latter class may be headed by the long-tailed tit, which, though plentiful enough in many places, is seen far less often near human habitations. With the long-tailed tit may be bracketed the still less familiar marsh, willow, bearded and crested tits.

Except for stray specimens that wander over from the Continent from time to time, all the tits in Great Britain are of the resident order. But within the limits of these islands most of them are nomadic, travelling about in small companies from one place to another during the winter, but probably returning to their familiar homes as spring approaches.

The robin himself is hardly more bold and fearless than the great tit, who with a very little encouragement learns to modify his natural distrust of man. He is one of the first to discover the coco-nut or lump of fat suspended outside the window, and after

a little while he will come and perch on the window-sill itself and take no more notice of the interested spectator within a few inches of him than of the bits of coloured rag with which the gardener tries to scare him away from the fruit trees in the orchard. For the great tit, unfortunately, is not to be reckoned altogether as the gardener's friend—not, at least, so far as that worthy, with his often too limited power of observation, is concerned. It is the bird's misfortune that on the point, even the fruit crop itself may sometimes owe its existence in part at least to the good offices of the much-abused tit. During the nesting season, and afterwards, a single pair of great tits will consume not only hundreds but thousands of insects, some of which are among the greatest of the gardener's enemies.

For many years past the writer has encouraged every kind of bird in his garden, but beyond the fact that the great tit has

Photo: G. A. Booth.

During the nesting season, and afterwards, a single pair of Great Tits will consume not only hundreds but thousands of insects, some of which are among the greatest of the gardener's enemies. The young Tits are voracious eaters.

his vices are ever more apparent than his virtues. The ruined fruit buds lying scattered upon the ground are sure evidence of mischief done; the devoured multitude of harmful insects—"blight," moths, caterpillars, grubs, *et hoc genus omne*—leave behind them no tale of good service done in that selfsame area where "them dratted tits" have, in the gardener's opinion, utterly destroyed the promise of the year.

It is, perhaps, impossible to strike a fair balance in regard to the handiwork of this and some other species of tits in the garden; but apart from fruit, there are other crops which might often completely fail if the tit did not help us to keep down the various insect pests that prey upon them. Difficult though it may be to convince the gardener on occasion—usually in a dry summer—done some damage to pears and apples when nearly ripe, he has nothing to say against this or any other member of the tribe. No damage to buds has ever been noted—in fact, so far as blossom is concerned, it would not matter in any season if half the buds were destroyed before they opened, for a fruit tree will always put out more blossom than it can comfortably "set."

No sooner do the days begin to lengthen than the great tit embarks upon that strange spring-time song of his—if song it can be called—which has been so aptly likened to the sharpening of a saw. His repertoire at this season is limited, for it consists of but two notes only, and these not of the sweetest, but it is a cheery little effort all the

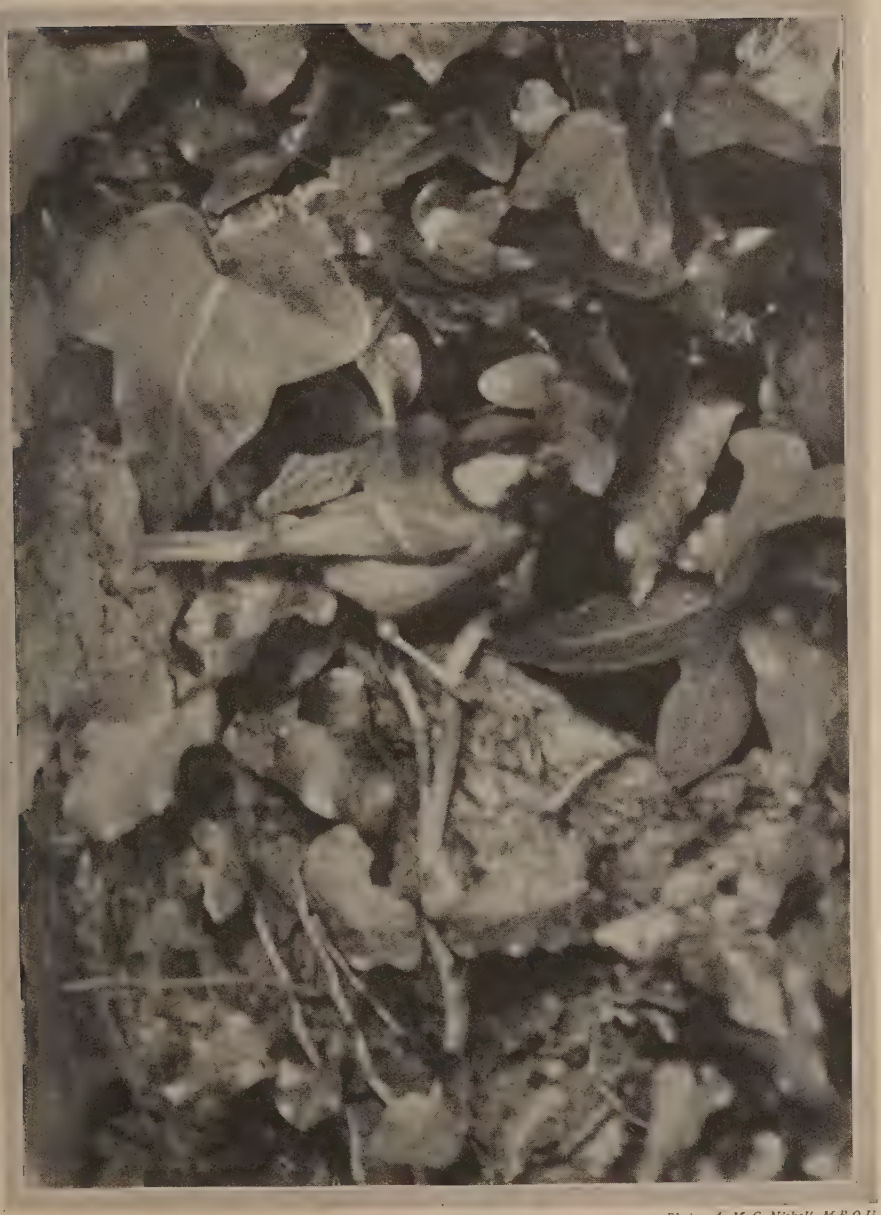


Photo: A. M. C. Nicholl, M.B.O.U.

GREAT TIT.

His superior size and the black markings on head, chin, and breast easily distinguish him from other members of the Tit family.

Photo: G. A. Booth

A Blue Tit and its hungry youngsters. All the Tits are believers in large families, for clutches of six to ten are quite common.

same, and one of the most welcome of those signs and symbols of the awakening year. Later on, as if conscious that during the season of courtship a greater effort is required of him, the great tit may attempt something with rather more music in it, but at the best he makes but small pretension to being a songster, and is often content to utter nothing more than a monosyllabic call, varied occasionally by a scolding note of displeasure at being disturbed.

The great tit is a bird of extreme activity, full of life and energy, and never resting except when he brings some toothsome morsel to terra firma the better to examine it. Even then he is not content to remain long in one position, but must be continually jumping up and down and turning round as if in a state of agitation or bad temper. These antics of his give the impression that time is of the utmost importance to him; yet for all his haste, little seems to be accomplished, and he wastes the greater part of his time in hurrying to no purpose.

At close quarters the great tit should not be easily mistaken for any of his cousins, for his superior size and black markings on head, chin and breast distinguish him clearly enough from the blue species, while his altogether brighter plumage provides a sufficiently striking contrast to the more dowdy general colouring of the coal tit. At a distance, however, it is not so easy to be certain. The black marking on head and neck is very similar to that of the smaller coal tit, though in the latter species it does not extend beyond the limit of the neck beneath, while on the crown of the head it is broken by a patch of white extending to a point midway between the shoulders. As for the blue tit, the blue colouring of head, wings and tail, with the dark and very distinctive streak across the eye, makes identification a simple matter.

All three species of tit just referred to nest in holes or crevices of trees or masonry, and each builds the same kind of matted nest. The eggs in each case have much in common. Those of the great tit are somewhat larger than the others, but all are spotted with red markings of varying size. Tits are believers in large families, for

clutches of six to ten are quite common, while many more are sometimes met with. It is almost certain, however, that where as many as fifteen or twenty eggs are found in one nest, more than one bird has been concerned in the laying of them.

For many years a pair of blue tits nested in a letter-box placed for private use in one of the brick-built gateposts of Woodmancote Vicarage in Hampshire. It is quite probable that the box is still similarly tenanted, for a permanent site like this is regarded by succeeding generations of tits in the light of an ancestral home. These tits went in and out by the slit made for the letters, and in spite of constant disturbance by the posting of letters, the dropping of stones through the slit by mischievous schoolboys, and the daily collection of letters by the postman, this enterprising pair of birds, or their descendants, managed to build their nest without a break during the sixteen years that the writer's father held the living. We ourselves, of course, were careful to disturb the birds as little as possible, always taking the key when letters were posted and arranging them carefully around the central depression in the nest which contained the eggs or young. But other people sometimes dropped letters through the slit, and if so be that one fell on the eggs, the tits did not hesitate to remove the obstruction, and sometimes in their displeasure tore it to pieces.

One year two depressions were made side by side in the matted collection of grass, moss, wool and hair that formed the nest, and a few eggs were laid in each—evidently by different birds. Then a fight seems to have taken place, for one day a terrible scene of confusion was discovered, with broken eggs and nest torn to pieces. Nothing more was done that year. On another occasion two birds must have put their contributions together, for more than twenty eggs were laid. Of these we removed several in view

Photo: F. Jefferson.

A Blue Tit bringing a grub to its nestlings. Its food almost wholly consists of creeping things which are injurious to plant life.

of the limited capacity of the box, which was no more than about ten inches square, and the remainder were hatched. The sitting bird was sometimes so tame that she would allow one of ourselves or the postman to lift her off the nest, and then when released, she would sit on the signpost opposite and swear roundly at us until we went away. The story of the Woodmancote post-box and its occupants was told in one of the magazines by a later vicar, but the birds, unfortunately, were described as long-tailed tits, which, needless to say, would never dream of nesting in a hole, and therefore would hardly select a post-box as a site for their nest.

Photo: Richard Kearton, F.Z.S.

The Coal Tit is a perky member of the family; it measures about four and a half inches in length. The black marking on the head and neck is broken by a patch of white on the crown of the head, which extends to a point midway between the shoulders.

There is one point in connexion with the favourite custom of feeding tits on coco-nut and similar unnatural food that may be put to the consideration of bird-lovers. The point is this—is it good for them? Undoubtedly the birds take a great delight in such dainties, but if these are actually harmful, is this not a case of mistaken kindness? The question is raised here because upon two separate occasions the writer has picked up beneath the suspended coco-nut the dead bodies of tits—in one case a great tit, in the other a coal tit. It seems strange that the birds should have been found in this position if the coco-nut had nothing to do with the tragedy. At the best of times a hard food like this, containing a quantity of fibre, must be very indigestible, and it is not unreasonable to suppose that a bird might so surfeit itself as to bring about fatal consequences. Again, if one bird be found dead on the spot, may there not be others which go away to die and are never discovered? Those who put out food for the tits for the pleasure of watching them come and eat it, would be well advised, it seems, to confine their offerings to such food as is more easily digested than coco-nut and some others of the harder foreign nuts. Walnuts and hazel nuts may be considered more natural fare, while a meaty bone could hardly do any harm. One imagines that too liberal a diet of fat might be almost as harmful to a tit as the coco-nut.

Apart from providing them with food, tits may be encouraged anywhere by being given suitable nesting places. Nesting-boxes may be purchased ready-made, and if these are firmly fixed in suitable positions, the tits will very soon find them out. Such boxes should be taken down after every nesting season and cleaned, and they should not be put up again until the beginning of the following April. Nothing in the way of nesting material should ever be put in the boxes, for the tits know far better than their patrons what material they require, and will invariably resent any such attempt to teach them their business.

SUPPLIES FOR THE FAMILY

A male Great Tit entering the nesting-hole

Photograph by F. Jefferson

A BLUE TIT CARRYING FOOD TO ITS YOUNG IN A NESTING-HOLE IN A WALL

Photograph by Albert H. Willford

A BLUE TIT AND ITS FAMILY

Note the optimist on the lower branch

Photograph by G. A. Booth

A PRETTY QUARTETTE

Young Coal Tits waiting for feeding time

Photograph by G. Henry

LINED UP FOR THE PICTURE

Young Blue Tits

Photograph by A. M. C. Nicholl, M.B.O.U.

Photo: Henry Willford.

At the first sign of their parents' approach the young Hooded Crows begin their noisy demands for food.

49.—IN THE HAUNTS OF THE HOODED CROW

By HENRY WILLFORD

WARY, suspicious and cunning, the hooded, or grey-backed crow, like all members of his tribe, provides ample sport for the hunter with the camera, and if he is ever to come within range of this elusive bird, the photographer will need all that he knows of patience and perseverance.

The very places that he chooses for his home makes access difficult, for the hoodie shuns the mild climate of cultivated lands, and rejoices mostly in the wild regions of the north. In autumn large numbers come over from the Continent, and they are fairly common along the east coast of England, but it is chiefly in Scotland, and particularly the north and the adjoining islands, that they take up permanent residence.

When trees are at hand the hooded crow builds in the topmost boughs, but in places where the climate is too severe for vegetation, he resorts to cliffs and caves, or any ruined buildings as may be found. In the treeless wilds of the Shetlands, where my photographs of the bird were taken, the nests were built in almost inaccessible places in the cliffs, and made of the only material that lay to hand—dried seaweed stems, clumsily put together but snugly lined with the wool of the far-famed Shetland sheep. One nest I found was, in addition, decorated with the skeleton remains of the gulls that are so plentiful in the islands—grim trophies of the aggressive exploits of these carrion-loving birds.

Out of the half dozen pairs of hoodies that were breeding on one small island, I found only two nests that it was possible to make use of, photographically. One of these was discovered by chance as the motor launch that was to land me on the island ran in between two large rocks. The female hoodie, disturbed in the act of brooding, flew off with noisy cawings and thus might be some hope of success. On examining the hide, however, I found it half submerged by the tide, and it was necessary to raise it at least another foot before I could hope to make it habitable, for though I was wearing a pair of waders I could see there would be little space to work in when the tide was up.

For the first two hours while I waited,

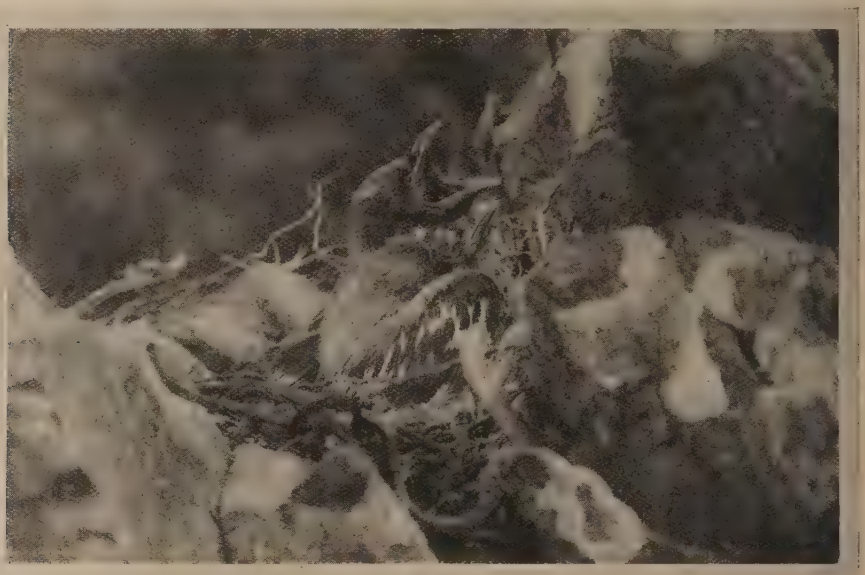


Photo: H. A. Wallace.

What a gape! A young Hooded Crow impatient! Feeding by regurgitation is the usual method, but on occasion food is brought visibly in the bill of the parent bird.

betrayed its whereabouts. I decided to watch this nest, as it was only some ten or twelve feet from the ground, and was moreover sheltered from the strong north winds —always one of the greatest difficulties with which the photographer in the Shetlands has to contend.

Unfortunately the only suitable place for my "hide" was on the boulder-strewn beach below, and at high tide this would be submerged. However, there seemed no second choice, so I set to work and fixed up an old discoloured tent. Then covering it completely with seaweed I retired, hoping the hoodie would soon return.

On the following day as the launch came within sight of the nest I was relieved to see the hen again fly off, and I felt that there with the water creeping higher and higher, the hoodies never came within sight. At last, just as my waders were almost submerged and I was about to give up in despair, without any warning one of the birds flew in from the sea and pitched a few feet from the nest. Motionless, in an attitude of extreme suspicion, it waited a moment, and then, unable apparently to resist the pleading clamour from the young ones above, it summoned all its courage and flew up to the nest.

Click went my camera shutter—and in a flash the picture was secured, and the hoodie had gone.

Then, cramped and stiff with the cold—for the temperature of the water in these parts seems never to rise much above

Photo: Henry Willford.

THE HOODED CROW.

The nest is frequently built in somewhat inaccessible sites on the rocky islets of the far north. Its materials consist of seaweed stems or other convenient fibres, but it is cosily lined with wool, hair, moss, or feathers.

freezing-point—I decided that I had endured sufficient for the one day, and retired to the warmth of the only habitation that the island boasted, meaning to continue my efforts on the following day.

On arriving at the nest early next morning, I found the young birds thriving, and by

Young Hooded Crows testing their wings preparatory to leaving the nest.

means of a little alteration in the hide, contrived to make my incarceration somewhat less unpleasant. By this time the old birds seemed to have got quite used to the strange-looking object poking out of the sea, and they came with food, apparently quite unconcerned. They seldom came together, but in the course of half an hour they each made several visits to the nest. Then there would be a lapse of two or even three hours, during which there was "nothing doing," and after that perhaps they would again appear several times in succession.

As soon as the tide began to ebb, both birds worked diligently in search of shell-fish and marine insects. These, with carrion and such eggs and young birds as they were able to glean in the course of raids over the surrounding country, formed the mainstay of their food. When feeding their young I only once saw food brought visibly in the beak; on every other occasion semi-digested pulp was thrown up from the crop and deposited in the gaping mouths in the nest. At the first sign of their parents' approach the chicks would begin their clamour, but unless they were startled—when they would fly off with loud cawings—the old birds never uttered a sound.

In the course of my explorations in the islands I found several other hoodies' nests, some with eggs and others with young. The number of eggs laid is about three to six, five being perhaps an average number. They have greenish-brown mottlings on a greenish ground, and vary considerably as to size. Many of the nests contained young of different ages, which fact would lead one to suppose that incubation starts before the full clutch of eggs is laid. There seemed to be rather a high mortality amongst these late-hatched birds, since several pairs only succeeded in fledging three out of their clutch of five.

Many interesting things occurred in the little bay while watching the hoodies. Seals were often to be seen and heard disporting themselves in the sunlit waters. Eider drakes, in all their black and white splendour, serenely wooed their sleek though quietly dressed little mates. Mergansers floated majestically backward and forwards, and farther out still, three great northern divers alternately swam and slept. The great and Arctic skuas, nesting on the moors above, made periodical flights out to sea in chase of some luckless gull. And ever and anon came the discordant cawing of the young hoodies.

Photo: M. Best.

A young Hoodie Crow in its full plumage and ready to start on its career of egg-plunderer.

Photo:
A. M. C. Nicholl, M.B.O.U.

The favourite nesting place of the Yellow Hammer is in a hedge bottom or a gorse clump. In coloration the female—here seen beside her nest—in no way compares with her mate.

50.—THE YELLOW HAMMER

By A. M. C. NICHOLL, M.B.O.U.

ALTHOUGH yellow hammer is the popular name of this species, to ornithologists it is the yellow bunting.

The word "hammer" seems to be derived from the German word *Ammer*, denoting bunting.

Now buntings and finches are frequently mixed up in flocks, and in many ways the two families resemble one another. Both are seed-eating birds, the flight of both is much the same; further, they are of similar build and size. How can we distinguish for certain a finch from a bunting?

Apart from the plumage of the birds, there is one test which will settle the question for us.

The buntings have attached to the inside of the upper mandible a sharp conical projection, which is of obvious assistance to them in separating the seed coat from the seed which it contains and on which they feed. No finch has this knob, and thus it may be used as a means of distinguishing the two somewhat similar families.

Even the most unobservant of country dwellers can hardly have failed to notice and admire the wonderful colouring of the male yellow hammer in his springtime dress. Even the more soberly coloured female catches our eye as she flits from the clump of gorse along the roadside, but she in no way compares with the canary colouring of her mate.

The telegraph wires which edge our country roads are favourite resting-places for the yellow hammer. There he sits for many hours each day singing his monotonous yet pleasing song—so quaintly rendered in our own language by the words, "*A little bit of bread and no cheese.*"

Photo: A. M. C. Nicholl, M.B.O.U.

Nest and eggs of the Yellow Hammer among gorse. The clutch varies from three to six, but is generally four or five.

Photo: Frank J. Martin.

A Yellow Hammer arriving at the nest with a beakful of food for the youngsters hidden in the depths of their grass and hair-lined home.

During the winter months these birds collect together into flocks and haunt the farmyards, where they can obtain the grain which forms their usual diet. But when spring arrives the flocks split up and visits are paid to the breeding grounds.

The favourite nesting place of this species is a clump of gorse, or some sheltered nook at the bottom of a hedge adjoining a cornfield. Often a nest is built in a black-

At first both birds were very shy, but soon they got accustomed to the queer structure and the lens of the camera peeping out.

The male bird was certainly the more attentive to the young at this stage, though I fancy that his mate was not so much in evidence on account of her nervousness.

When he had fed the young several

Photo:
A. M. C. Nicholl, M.B.O.U

The Yellow Hammer is a devoted parent. The photograph shows a female bird sheltering her nestlings from the glare of the sun.

thorn hedge, but rarely at any great distance from the ground. Bramble, too, is sometimes used as a hiding-place for the rather rough and bulky nest.

Whether both of the birds help to make the nest I have hitherto had no chance of ascertaining, but after the young are hatched they are certainly tended and brooded by the male as well as the female.

A pair of these birds had made their home in a very thick bramble clump not far from my house, and I spent very many days photographing them and noting their habits. The bramble bush was so dense that a way had to be cut through it with a hook before a hiding-tent could be erected.

times the male tried to persuade the mother bird to come to the nest and, after several attempts, succeeded in doing so, though she brought no food supplies with her.

After the first plunge, however, she quickly plucked up her courage and was at the nest more frequently than the male.

It is interesting to be able to record that the young were fed entirely on caterpillars.

At exactly what age the change to a seed diet takes place I do not know. In this respect the yellow hammer resembles the chaffinch, for the latter feeds the young on caterpillars while still in the nest,

Photo. A. M. C. Nicholl, M.B.O.U.

MALE YELLOW HAMMER AT THE NEST.

Strikingly beautiful as this bird is when seen in front, the wonderful coloration of the head, back and tail reveals a charming blend of greenish yellow, chestnut, and black. He takes a good share of the work of tending the young.

changing over to seed at a more advanced age. On the other hand, I have frequently observed that the goldfinch, the greenfinch and the common linnet, all seed-eating birds, feed their young, while still in the nest, on regurgitated seed.

In the case of the yellow hammers, food was brought to the young about once every twenty minutes, but as only three youngsters occupied the nest, there was not a full clutch to be fed.

When accustomed to our visits, the parent birds would remain at the nest while we entered the hiding-tent only some few feet away.

Occasionally the male would try to brood the babies, but this they appeared to resent, and he was usually pushed off by the struggling family, whose sole idea in life seemed to be the getting of more food.

Photo: Stanley Crook.

The young Yellow Hammer shows a striking resemblance in coloration to the parents. The breast and throat expanses are yellow, and occasionally the breast is spotted reddish brown.

When the sun fell strongly on the young, the female more than once remained perched on the side of the nest and, spreading her wings umbrella-like, shielded the youngsters from the fierce rays. It was noticeable that though she was very attentive in this way to her brood, the male never attempted to do the same.

In view of this care it was surprising to find that when a very heavy shower of rain came on, neither parent turned up to cover the brood, but left them to be soaked through and through. Later the female arrived and covered them, wet through as they were.

This is peculiar as far as my experience goes, as most birds are very particular about covering their young whenever rain comes on.

I was much struck not only by the devotion of the pair to their family and the wonderful colouring of the male bird, but also by the beauty of its tail, which was strikingly shown as it was spread against the side of the nest while food was being distributed.

There is no doubt that the use of a hiding-tent teaches one a great deal about both the plumage of the adults and the food given to the family, as well as the behaviour of the birds at the nest. Here we have a seed-eating bird, universally condemned by farmers and others, actually "doing its bit" by feeding its nestful of young on the all-devouring caterpillars!

Two broods, if not more, are usually brought up by the yellow hammers. I have found a nest with eggs as late as August 24th on Dartmoor.

In some of the southern counties of England the yellow hammer may be confused with the cirl bunting. The songs of the two species, though they are not unlike, are, however, distinguishable in the breeding season, that of the cirl bunting may be recognized as the "*Little bit of bread and no*"—without the "*cheese*" being added, the whole song becoming almost a trill. The last sad note of the yellow hammer's song is omitted.

The black chin of the male cirl bunting further distinguishes him from his commoner relative.

Life of the Sea Shore

2.—STORY OF THE SEAWEEDS

By S. LEONARD BASTIN

With photographs by the Author

DURING a visit to the coast there are few more fascinating occupations than a study of the seaweeds. Strolling along the strip of sand which the receding tide has left behind, one may pick up fragments of those curious and often extremely beautiful plants which form the flora of the sea. Even those who have a fair knowledge of field botany are bound to admit that the seaweeds present a host of unfamiliar problems. Here and there we can identify a common species by its popular name, but of its habits of growth we have to confess ourselves more or less ignorant. Let us, therefore, at the start try to get an idea of some of the characteristics of this marine flora which is so distinct from the vegetation of the land.

Practically speaking, the plant life of the ocean is restricted to one group—the algæ—all of which are more or less aquatic in habit. In passing, it is interesting to notice that even the sea can boast of a few real flowering plants, and these are represented in British waters by the solitary genus *Zostera*. The grass wrack, as it is commonly called, abounds all round the coast, and at low water the long green leaves are often seen to cover vast areas of the sea bottom. The pollen grains produced by this curious plant are of the same specific gravity as sea-water, so that they can remain floating at any depth and will be carried by the currents to the large stigmas of the female flowers. But, with this solitary exception, the vegetation of the sea ranks with some of the simplest forms of plant life.

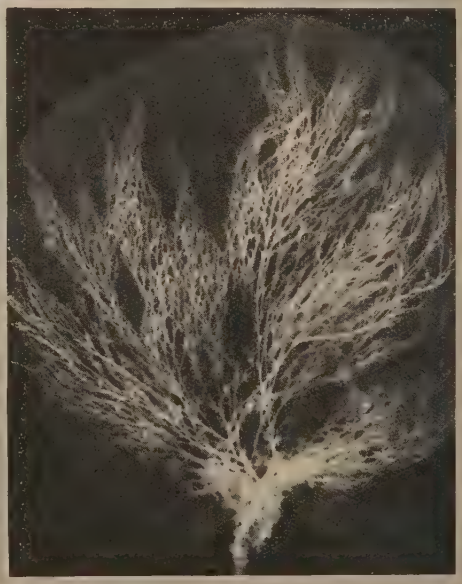
For the sake of convenience one may speak of the leaf, stalk, and root of a seaweed, but these terms have only a limited application. On many specimens which we may collect there is to be seen a root-like process, but this is chiefly a means by which the plant can attach itself to some position. It will play no special part in the scheme of nutrition such as is evidenced in the roots of the higher plants. With a few exceptions all marine algæ, apart from the plankton or floating life of the open waters, require for their well-being a fixed situation. After a great storm, when the beach is strewn with seaweed, the fragments will have been torn from some rock or wooden pile, and in many cases it is doubtful whether they will ever settle down again.

The bright green foliage of the Sea Lettuce (*Ulva*) is commonly found in brackish estuarine waters. The plant thrives most vigorously in water that is rather impure, but ranks as a table delicacy under the name of "oyster green."

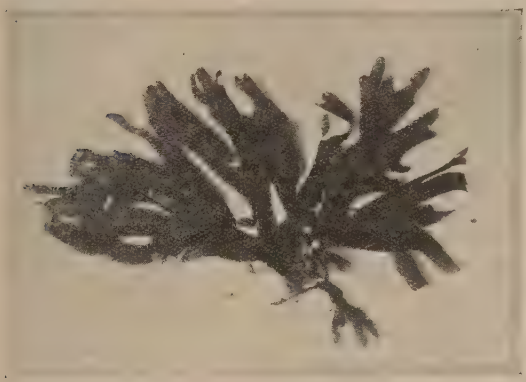
All the seaweeds depend for their existence upon being covered at intervals by the ocean, although some are able to thrive in positions which are submerged only for a few hours at high tide. On the other hand, there are numerous species which must be constantly beneath the waves—any exposure, even for a short while, being fatal. It is an interesting point to consider what are the limits of depth to which the marine flora extends. Save in very clear waters, it appears that at a depth of 150 feet below sea-level all growth ceases. The reason why plants are unable to persist at a greater depth is to be found in the fading out of the light. Light is essential for the self-nutrition of seaweeds (which are, of course, "green" plants whatever their colour may appear to be), and the rays as they pass through water are enfeebled. Even the quality of the light is altered. The red and yellow rays are gradually absorbed, and the light as it descends turns from white to green, then to blue, and, before it goes out altogether, to a pale ultramarine.

A pretty red Seaweed (*Polysiphonia elongata*). Although classed as red for the purposes of convenient generalization, some of these weeds may be brownish or purplish in tint.

It is in connexion with this modification of light that one of the most interesting problems concerning seaweeds arises. Roughly the marine algæ may be divided into three groups: the green, the brown, and the red seaweeds. It is important to remember that these terms must not be taken in an arbitrary sense so far as the actual colours are concerned. Some of the red seaweeds may be purple or brownish in tint, whilst a common green seaweed, *Cladophora*, has branches which vary in shade from brown to grey. Still, the curious fact remains that we can for practical purposes think of the seaweeds in the three colour groups. Of these, the green seaweeds are more prevalent in the shallow waters



A luminous red Seaweed, one of a number known to be phosphorescent, and, where it appears in abundance, the deep-sea waters glow with a weird green light.



The Pepper Dulse (*Laurencia*) is purple in colour, and ranks as an edible seaweed with a hot biting taste.

where the red kinds are comparatively scarce. The brown seaweeds extend from the highest levels downwards, but mostly stop short of the deeper waters. Where the red seaweeds abound, perhaps a hundred or more feet below the surface, the light, as we have already seen, is changed and weakened. The difficulty from the plant's point of view has been overcome by colour adaptations. In the manufacture of its chlorophyll the plant needs mostly the red and the orange rays, which are increasingly deficient as the water deepens. The pigments found in the red seaweeds act as a screen, enabling the chlorophyll to utilize those rays of light which alone are of service. A number of the red seaweeds are known to be phosphorescent and, where they abound, the depths of the sea glow with a weird green light.

To a more limited extent the same process is to be observed in the case of the brown seaweeds, which chiefly inhabit more shallow water than that favoured by the red group. So that both the red and the brown algæ, although living under many feet of water, do not suffer at all from the fact that their light reaches them through a watery screen. In the shallow waters where the green seaweeds abound there is very little interference with the light rays, and hence colour adaptation is unnecessary.

Generally speaking, the green seaweeds are not likely to attract a great deal of attention. The best known are probably the sea lettuces (*Ulva*) which often abound in pools that the receding tide leaves behind. The bright green foliage of the sea lettuce is a familiar feature of the brackish water found at the mouths of rivers. Strangely enough the plant thrives most vigorously where the water is rather impure, such as in the neighbourhood of a harbour or in the vicinity of drainage-outfalls. Where the sea-water is more wholesome will be found some of the species of *Cladophora*, small olive green plants with a bushy habit of growth. Another group of green seaweeds known as *Rivularia* is represented by three or four species which, insignificant as individuals,

Bladder Wrack (*Fucus vesiculosus*) varies considerably in accordance with its environment. It is a very accommodating plant, and is kept floating by means of air bladders.

Tangle Weed (*Laminaria digitata*) is a very common brown seaweed, with a large leaf divided into segments resembling great fingers.

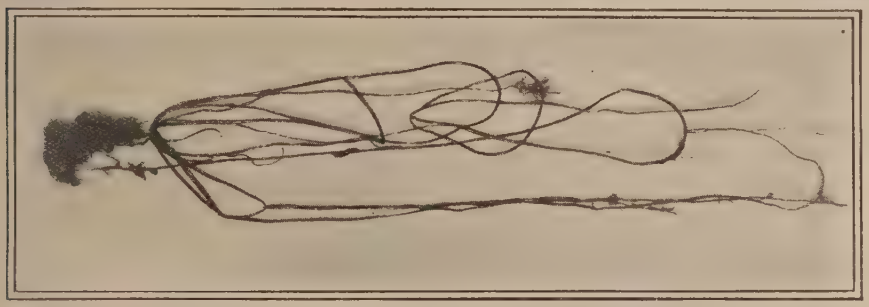
parts of the coast where some of the brown seaweeds are not found in great abundance. One of the commonest is certainly the bladder wrack (*Fucus vesiculosus*). It is a very accommodating plant, for it grows on rocks and piles that may be uncovered for hours and, as well, is just as happy in positions from which the tide rarely recedes. The foliage, which is freely branched and of a brownish olive colour, is curious on account of the fact that it is kept floating in the water by means of air bladders. Another very common brown seaweed is the tangle weed, *Laminaria digitata*. This plant has a huge brown leaf which is divided into segments resembling great fingers. A notable feature is the large thick stem ending at the lower part in a thick cluster of root-like processes. The tangle weed attaches itself very securely to the rocks on which it grows and the leaves may be five or six feet long. Only at very low

are very much in evidence collectively. Large colonies of *Rivularia* are responsible for the extreme slipperiness of the rocks left uncovered by the tide.

The manner in which the green seaweeds are reproduced is not, in all cases, completely understood. One method has been observed in the case of the sea lettuce on the following lines: After a period of vigorous growth a change takes place in the contents (known as protoplasts) of the masses of cells which go to make up the plant. At this point the protoplasts start to subdivide and finally escape from the cell walls in which they have been imprisoned. These little bodies, called zoospores, move about in the water by means of long hairs, and after a while settle down on the sea, where eventually the formation of new cell walls begins. Thenceforward the extension of cellular tissue goes on rapidly and, in the end, a new sea lettuce arises.

Probably there are few

The "Oak-leaf" Seaweed (*Delesseria sinuosa*) displays bright rose-coloured leaves about five or six inches in length. It is commonly found on rocky coasts.



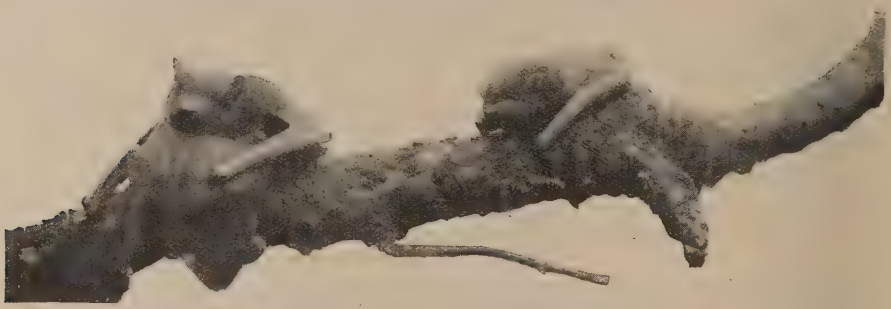
Sea Whipcord (*Chorda filum*) has rope-like stems which sometimes attain a length of thirty feet or even more.

tides is this giant seaweed exposed, and often it grows in comparatively deep water. The sweet tangle (*L. saccharina*) is a large species with long leaves curiously curled at the edges. The plant grows attached to rocks which are but rarely exposed, although the giant leaves can often be picked up on the beach after a storm. In similar situations is found the sea whipcord (*Chorda filum*) with its rope-like stems often thirty feet or even more in length. A large genus known as *Ectocarpus* is chiefly represented by very filmy plants, which attach themselves to the *Laminarias* and other big seaweeds.

Without a doubt the most beautiful of all the sea-plants are those grouped together as red seaweeds. Many of these are of amost delicate description with branches attractively coloured in shades of red and pink. Quite often the smaller kinds grow attached to the large brown species, and even on shell-fish. Amongst the most graceful of them are the *Callithamniums*. These, in one form or another, are common on all coasts, and are at once recognized by their feathery branches of a very bright pink colour. Rather more substantial, and somewhat less brightly coloured, are the *Polysiphonias*. Here the main stems are long and fairly thick, but the growth is freely divided into many thread-like branches. More leaf-like in their formation are the *Delesserias*, one species of which is common on rocky coasts. This is known as the "oak leaf," and is really a beautiful plant with foliage of a bright rose colour five or six inches in length. A smaller *Delesseria*, often found growing on large brown seaweeds, is *D. alata*, a delicate plant with branching stems of a dark crimson colour.

The Sweet Tangle Weed (*Laminaria saccharina*) grows upon rocks which are only exposed at low tide.

Even to-day some of the seaweeds are eaten, although whether they are very nice is a matter of opinion. The sea lettuce occasionally appears on the table as a delicacy known as "oyster green." The pepper dulse (*Laurencia*) is an edible seaweed, purple in colour, with a hot biting taste, whilst certain dark red species are stewed and eaten under the names of "laver" or "sloke."



The Noctule Bat is a gregarious species, and considerable numbers will congregate together for their winter sleep. It is easily distinguished from other bats by its comparatively large size.

18.—THE LARGEST AND SMALLEST BRITISH BATS

By CLIFFORD W. GREATOREX, F.Z.S.

With photographs by Frances Pitt

WITH the exception of the mouse-coloured bat (*Vespertilio murinus*), a species very common on the Continent of Europe and exceedingly rare within our i les, the noctule, or as it is often called, the great bat, is the largest British representative of the order *Chiroptera*. The term *Chiroptera* comes from the Greek, and means "wing-handed."

The noctule (*Vesperugo noctula*) is not likely to be confounded with any other British bat, and its characteristics are easily remembered

To begin with, its size is large. The wing expanse measures from thirteen to fifteen inches, and the length of the head and body is easily three inches; that of the tail is about two inches. The wing membranes arise from the ankles, whereas in the other members of the same genus they originate from the bases of the toes. The ears are large and bluntly rounded, and almost as broad as they are long; they are set widely apart on the head. The tragus (earlet) is short and squarish. The head is decidedly broad and flat, and the swellings at the sides of the muzzle are prominent. The nostrils, which are extended downwards and outwards, have a pronounced cavity between them. On the upper parts the fur, which is everywhere somewhat long and very soft, is yellowish brown; and below, the hue is only slightly paler. Some examples are reddish. The muzzle, the ears and the wing-membrane are dusky; the latter being darker and of a thinner texture towards its margin.

The noctule is fairly common in the southern and midland counties of England, but farther north it is seldom met with. Apparently it is absent from Scotland and Ireland, and it is doubtful if it occurs in Wales. The first naturalist to speak of it as a British species was the renowned Gilbert White, who studied its ways in Hampshire. He stated, however, that in that county it was rare. The noctule is found very widely on the mainland of Europe, and its range extends through the temperate regions of Asia into Africa north of the Sahara. It occurs also in Java and Sumatra, and in parts of India.

A tree-haunting species, the noctule is met with generally in districts that are fairly well wooded. Usually the hours of daylight are spent in a hollow tree; and, at one time, it was supposed that this bat never resorted to any other situation for the diurnal sleep. But to-day it is a matter of common knowledge that for this purpose the noctule will retire to the depths of ivy growing on an old wall or on a gnarled tree-trunk; also, that a thatched roof affords suitable shelter. I have myself found this species asleep by day in a crumbling tower. None the less, hollow trees are preferred wherever they are available.

Early in the evening is the time when the noctule appears on the wing, although its name might lead one to suppose that it did not venture from its hiding-place until a much later hour.

Its flight is very strong, powerful, and frequently sustained. Wonderful aerial feats are performed in the upper air. Apparently the chief reason why the upper regions of the air are selected is because there abound its favourite victims—large beetles and moths.

Cockchafers and fernchafers are devoured in great numbers by the noctule, and in this connexion we cannot do better than quote from the writings of Professor Thomas Bell. That authority remarks: "The noctule is essentially adapted for the capture and mastication of coleopterous insects. The broad muzzle and strong jaws are found quite equal to the reduction of the stubborn elytra of beetles as large as the cockchafer, of which he will consume as many as thirteen, one after the other, and the wings are in no way deficient in power when in pursuit of these insects. During the fine midsummer evenings, when the cockchafers have become abundant, and you hear them humming on every side, the noctule is in his glory. Then he flies high and straight, and you hear his shrill but clear voice as he passes overhead, interrupting himself to dart at some prey, and then passing on. But an observer will not watch his movements long on such an occasion without noticing a manœuvre which first looks like the falling of a tumbler pigeon, but on closer observation proves to be simply a closing of the wings and a consequent drop of about a foot. Sometimes this is repeated every few yards as long as he is in sight. It is occasioned by some large and intractable insect having been captured, and the anterior joint of the wing, with its well-armed thumb, is required to assist in retaining it until masticated."

The Noctule is a tree-haunting bat, and generally met with in districts that are fairly well wooded. The daylight hours are usually spent in a hollow tree.

The noctule is a gregarious species, and sometimes considerable numbers are found together in their winter quarters. The situation selected for the hibernal sleep may be a cavity in a tree, under a roof of an outbuilding, or the eaves of a house or a church tower. It is stated that many years ago more than one hundred and eighty-five bats were taken during a single night from beneath the roof of Queens' College, Cambridge, and sixty-five on the evening following. Though some of these

bats may have been of other species, a large proportion of them consisted of noctules. The noctule has an offensive odour, and to interfere with a colony is not the most agreeable of experiences.

Gilbert White was of the opinion that the noctule is not to be seen on the wing before the latter part of April, and that it retires again into seclusion before the close of July. But other naturalists have noticed this bat engaged in its wonderful flights, in Hampshire and elsewhere, in August and September. In Nottinghamshire I have seen it on the wing every evening during the first week in October. It issued regularly from the darkness of a cavity in an ancient oak that stood in the middle of a field, near a much frequented street. Certainly, in this instance, the weather was exceptionally mild ; and, after a night of frost, I did not see this noctule again.

The wing expanse of the Noctule measures from thirteen to fifteen inches, and the length of the head is easily three inches. This specimen lay in this position but for a moment.

The newly-born young are quite naked and blind. On the Continent, at any rate, two is the usual number at a birth. Captive specimens in England appear to produce only one.

There is another bat that, when in flight, may be overlooked because of its general resemblance to the common bat or pipistrelle (*Vesperugo pipistrellus*), especially when it happens to be present in a situation where the latter is abundant. This is the whiskered bat, the *Myotis mystacinus* of systematists.

Compared with the pipistrelle, however, the whiskered bat is rare, although to-day some naturalists describe it as being " generally distributed." Previously, writers always mentioned the particular localities in which it had been found, such as the Lake District, Northamptonshire, Warwickshire, Leicestershire, Cambridgeshire, Kent, and the Isle of Wight. Personally, I have records of its occurrence in Nottinghamshire, Hampshire and Derbyshire in the years 1914, 1915, and 1920 respectively.

There is considerable difficulty in studying the ways of a creature that normally spends the daytime and the whole of the colder months hidden away in more or less inaccessible nooks, coming forth only in the twilight and darkness during the warm seasons of the year.

One of this bat's chief features is its smallness. It is the smallest British bat. The total length of the head and body does not exceed one and a half inches ; that of the tail, one inch and two-fifths ; and the wings, from tip to tip, measure eight and a half inches.

The whiskered bat belongs to the genus *Myotis*—the mouse-eared bats. In the members of this genus there are present thirty-eight teeth. The upper incisors (cutters)

are so placed that they diverge from one another. The cheek teeth are very numerous. The ears are oval and somewhat elongated in form, having pronounced indentations in the middle of the outer border. The tragus or earlet (a prominence at the entrance of the outer ear) is straight, and rather blunt at the tip.

The name whiskered bat is given on account of a well-defined character. On the upper lip is a fringe of long, fine hairs, and on the chin are some hairs that are decidedly stiff.

The fur throughout the whole body is moderately long, especially on the face. On the upper parts it is dusky black, tipped with rufous; below, it is tipped with ash grey and is blackish at the roots. The wing-membranes are dark, marked with very numerous transverse lines; on the membrane between the hinder limbs (*inter-femoral membrane*) there are no fewer than eighteen of these lines.

The whiskered bat is more delicate than the pipistrelle, and cannot stand the inclemencies of the English climate so well. It therefore retires earlier into its winter shelter, and stays there later in the spring than does the hardier common bat. It is usually a solitary species. When food is extremely plentiful, however, in some particular spot, it may be seen sporting in little companies in the midst of its insect victims. It appears on the wing early in the evening, to feast on small moths, midges, gnats, and so-forth.

The partiality of the whiskered bat for water has often been noticed. I have seen one skimming over the surface of a woodland pool, disappearing and reappearing

A Noctule Bat photographed at the moment of taking flight from a branch. In this illustration the hook on its wings may be clearly seen.

The Whiskered Bat rests throughout the day in a hollow tree or cave, or in any convenient outhouse.

A portrait of the Whiskered Bat taken with its mouth open, squeaking at the photographer. This bat is more delicate than the pipistrelle.

amid the deepening twilight like a large, swift-winged moth; or, shall we say, like the ghost of a swallow?

The flight of the whiskered bat is usually low and rapid. I have observed this fascinating creature perform amazing evolutions in pursuit of a nimble fly, increasing and decreasing its level of flight, zigzagging and swooping in a truly wonderful manner, and in the end, triumphantly securing the fly.

Throughout the daytime, and when in hibernation, the whiskered bat resorts to a hollow tree, the roof of a building, or a cave. Many have been found in chalk-caves. One July morning I discovered one asleep in an old boat-house on the bank of a lake.

Towards the close of June, or early in July, a single young one is born. I once saw a female of this species with her young one clinging to her body—the customary way of conveyance—emerging from a hole in a tree-trunk. Just at that moment a weasel, running along a bough, tried to seize her. The bat uttered a shrill squeak, and, with marvellous agility, dashed the tip of a wing in her enemy's face, then swerved beneath the bough, and escaped into the open air.

The small size of the Whiskered Bat may be seen here, where it is compared with the fingers of a hand. It is the smallest of all our British Bats.

25.—THE LIFE STORY OF THE GOOSEBERRY SAW-FLY

By RAY PALMER, F.E.S.

With photographs by the Author

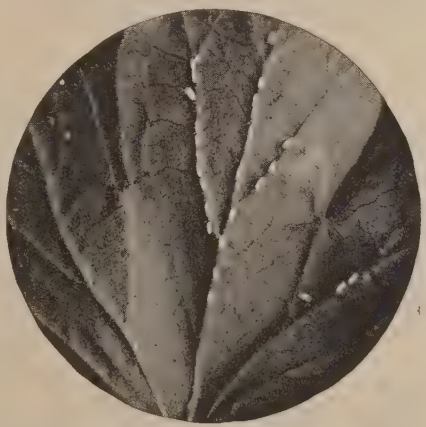
ONE of the best known of the saw-flies is that associated by name with the gooseberry; at least its larva is well known. Every gardener is familiar with the "gooseberry grub," though probably not with the saw-fly itself.

The name "saw-fly" is derived from a most remarkable feature, which indeed is the chief characteristic of the family. The modification of the ovipositor is a feature of the order *Hymenoptera*. In ants, wasps and bees it is formed into a sting, and undergoes special modification in ichneumons, gall wasps, and the other groups; but the ovipositor of a saw-fly is one of the most wonderful and beautiful examples of the adaptation of an organ to a special purpose, as was shown in the article on the palisade saw-fly (p. 732).

When the insect wishes to deposit her eggs, she settles on the bark or leaf of a particular plant, according to the instinct of her species, and proceeds to cut a slit with her ovipositor. Each egg requires a separate slit, the depth, position and nature of which vary with the species. Some completely embed their eggs in the tissue of the leaf; while others, such as the gooseberry saw-fly, only partly insert them in the slits, which they merely use as a means of attaching their eggs to the leaf.

The gooseberry saw-fly first appears in April and early May, and deposits its eggs on the young leaves of the gooseberry and sometimes the red currant. The eggs are placed in more or less regular rows along the mid-rib and principal veins on the underside of the leaf. The first illustration shows about thirty eggs in this position, but forty or fifty may sometimes be found on one leaf. The leaves low down near the ground are generally attacked first.

The eggs hatch in about a week, more or less according to the weather, and there emerge tiny larvæ, green in colour, with very minute black spots and with yellow



Eggs of the Gooseberry Saw-fly on the underside of a leaf. (× 2.)

colouring on the last two segments of the body and on the first two behind the head, which is black. At first they feed only on the epidermis of the leaf, but in a day or two eat holes right through. They cling on to the edge of the hole and rest with their tail-end elevated and slightly curled up. This position is very characteristic of saw-fly larvæ, and may be seen from the second illustration. The fifteen larvæ here shown are not more than three or four days old, and their empty egg-shells may be discerned along the mid-rib of the leaf. When it is realized that these little larvæ

are shown magnified two diameters, it is easy to understand how they escape observation at this stage, as they are less than an eighth of an inch in length.

They have insatiable appetites, and make short work of the leaf on which they are hatched, leaving only the three principal ribs, which may frequently be found with the egg-shells still attached to them. The larvæ then proceed to the next leaf, which they usually devour completely. They feed voraciously, and soon strip the branch on which they are situated. In fact, eating is the sole purpose of their larval existence; they are said to devour more than twice their own weight every day, and to realize what this means we should remember that an average man eating at the same rate would consume three hundredweight of food every twenty-four hours.

As the larvæ increase in size they become much more spotted, and the green colouring becomes paler, and in many cases is only a greenish white. The green is largely due to the contents of the body showing through the skin, as it is in most caterpillars.

The full-grown gooseberry saw-fly larvæ lose their spotted appearance after the last moult, and become pale green with orange at the tail-end and behind the head, which is now brownish instead of black. When their development is complete, the larvæ fall to the ground and spin parchment-like cocoons just below the surface. These cocoons are made of silk mixed with saliva, and small particles of earth adhere to their surface, making them very difficult to find. The real colouring of the cocoon cannot, therefore, be seen until the earth is scraped off. It varies greatly, some being deep brown and others yellowish.

Larvæ of the Gooseberry Saw-fly on the underside of a leaf. (*Natural size.*)

The very young larvæ of the Gooseberry Saw-fly (× 2). Their empty egg-shells may be seen along the mid-rib of the leaf.

Within a day or two of the completion of the cocoon the larva changes to the pupa, which is a beautiful object. At first it is creamy white, but later becomes darker, indicating the tints of the perfect insect. Every part of the saw-fly can be plainly seen in the pupa. The embryo wings are folded close down to the thorax; the antennæ lie one on each side of the body, which they nearly equal in length, and the legs are drawn up against the under-surface.

The pupa state lasts two or three weeks in the summer. There are several broods of this insect during the year, usually three. The larvæ from the spring brood begin to pupate towards the end of May, and produce the second brood of saw-flies early in June. The larvæ from these are often mature by

the end of the month, and a third brood then appears in July. The larvæ from the third brood usually spin their cocoons in

Cocoons of the Gooseberry Saw-fly. The four at the top have had most of the adhering earth removed; hence their lighter colour. (× 2.)

August, and hibernate within them in the larval state, pupating in the early spring and producing the first brood in April.

Cold and wet weather is very detrimental to these larvæ, and frequently fatal; in any case it retards their growth, and so may reduce the number of broods in a season.

The female saw-fly is about a quarter of

Pupa of the Gooseberry Saw-fly. The embryo wings and the antennæ can be seen plainly. (× 3.)

an inch long and five-eighths of an inch across the expanded wings; the head and the front part of the thorax are black, and the abdomen and back part of the thorax orange yellow. The male is smaller than the female and darker in colour. These insects may frequently be seen on and around the bushes. They do not fly far, and so are remarkably local in their distribution. The larvæ may swarm in one garden, while the next is more or less free. Once this "pest" becomes established, however, it is very persistent; unless strong measures are taken to deal with it, it will increase steadily year after year, being checked only by an unfavourable season.

It is most noticeable that very different sized larvæ may be found together on the same bush; this is due to the fact that the eggs are laid, and consequently hatch, over a period of several weeks. Some of the first hatched larvæ may have pupated before others of the same generation have hatched from the egg. The broods also overlap, so that old larvæ of one generation may be feeding side by side with young larvæ of the next, and thus it is even possible to find every stage, from egg to perfect insect, at the same time.

Gooseberry Saw-flies: Male and female. (× 2.)

Another interesting feature of the life history of this and other saw-flies, is that the phenomenon known as "parthenogenesis" occurs frequently. The male of the gooseberry saw-fly is much scarcer than the female, and in some species the male is as yet quite unknown. It has been shown by experiment that at least three generations can be produced by females only.

The larvæ of this saw-fly are attacked by quite a number of ichneumon parasites, and the larvæ of the lace-wing fly will also devour them when young.

26.—OUR FRIEND—THE LADY-BIRD

By MARY LEE

THE lady-bird (*Coccinellidæ*), the little red beetle so beloved by children, has not always been so popular among adults, because its "mission" was misunderstood.

Eggs of the Two-spot Lady-bird (*Coccinella bipunctata*) surrounded by young aphides, on which these lady-bird larvæ, when hatched, will prey.

Its claim to be our friend is due to the fact that both as grub and perfect insect it feeds upon the aphis, or green-fly, which is one of our worst garden and orchard pests.

It is found almost everywhere. In Great Britain alone there are about forty different species, yet although it is so common, the stages of its life-history are not easily traced.

The yellow eggs are laid in small batches in the midst of the aphis, so that the larvæ, when they emerge, find themselves surrounded with a plentiful food-supply. Of this they take fullest advantage, devouring the green-flies in a business-like manner, and continuing their work of destruction almost without cessation. They are provided with mandibles suitable for holding and sucking the juices out of their victims.

Rather less than a minute is spent in extracting the contents of the abdomen and softer parts of the body of each aphis. This is not done without a struggle on the part of the hapless victim, but it is really defenceless, as it is fixed to the plant by a kind of beak. The head, thorax and legs are usually discarded, as being too tough even for such strong jaws, and it is quite a

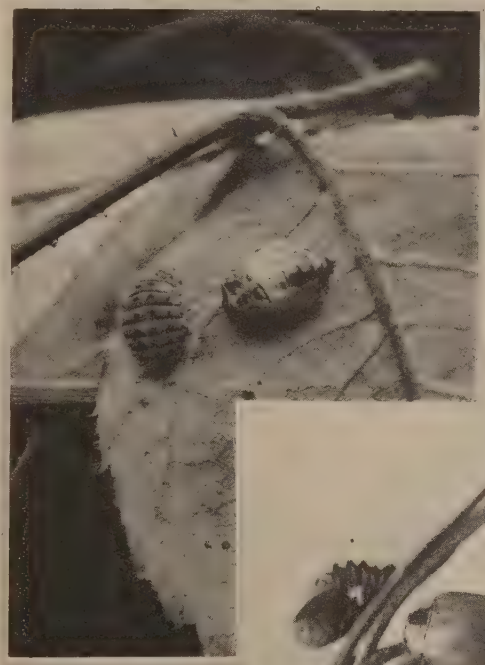
Photos: A. Harold Bastin.

A hungry larva of the Two-spot Lady-bird on the prowl.

common sight to see large numbers of these "remnants" lying about on plants. A strange phenomenon is that the aphis does not always die immediately. Sometimes a mutilated insect may be seen to crawl away after being thrown aside by its arch-enemy, and for a time it will live on without internal organs.

In appearance the larva is very different from the perfect insect. It is a slate-coloured grub, about half an inch long, with yellow markings on the underside. The body is flat and broad, tapering behind, and soft in texture. The six legs are rather long, and there are tufted tubercles. When moving about it can use the tip of the abdomen to help in pushing the body along. During the two to three weeks of the larval stage it grows fast, and changes its skin several times. Then it settles on a leaf, and secretes a sticky fluid from the abdomen tip, which fastens it securely. The hairs drop off, the skin splits along the back, and by the wriggling movements of the body inside it is pushed towards the tail-end, where it lies in a wrinkled mass. The pupa is seen as soon as the last larval skin is cast off. It suspends itself by the tail, and when disturbed swings itself to and fro several times.

After another fortnight or so the perfect insect appears, and continues the beneficent work it began as a grub.



Pupæ of the Two-spot Lady-bird Beetle. On the left, the larval skin has to be moulted. The one on the right has moulted its last larval skin and changed to the pupa stage.

The body is arched above and flattened beneath, and the feelers are slightly clubbed. Unfortunately, the lady-bird is noted for its unpleasant odour, which comes from an acid liquid secreted in the joints of the limbs. This is probably a defence against its enemies, especially birds, which otherwise might be tempted to eat it. As it is, they are highly distasteful to birds and mammals, and so well is this recognized that their colouring has been mimicked as a safety trick by spiders and such little creatures whose soft bodies would make for birds a nutritious meal. When present in large numbers, as they are during some summers, they make life distinctly unpleasant for unfortunate humans in their vicinity. They can fly extremely

Photos: John J. Ward, F.E.S.

Two-spot Lady-bird Beetle (*Coccinella bipunctata*) just emerged from its pupa skin (shown above), and drying its wings before folding them under its wing-covers. When first emerged it is of an opaque cream colour. The red wing-covers and black spot take several hours to develop. (× 4.)

Photo: John J. Ward, F.E.S.

Lady-bird Beetle (*Coccinella bipunctata*), showing its flying attitude and, plainly, the black spot on each of the wing-covers. (*Greatly enlarged.*)

species the insect may be red, brown, yellow, or black, while the markings are in the shape of spots, bars or blotches, and these differences may be found even in the same brood. Perhaps the best known is the seven-spot, so called on account of its seven black spots, one of which is in the centre, and two near the edge of each wing-case, the seventh being at the base of the suture where the wing-cases meet.

A curious point is that when the green-fly is especially plentiful, the lady-birds appear in equally large numbers, the same conditions apparently causing both to be prolific. Lady-birds are capable of travelling considerable distances, following up the aphis in its migrations, flying on the same winds.

well, but creep slowly. They are most prolific, two or three successive broods hatching out in a season. In the autumn the survivors crawl into some nook in mossy banks, or under the loose bark of trees, and there remain dormant throughout the winter.

Even among the British species there are considerable variations in colour and markings. One of the most common is the two-spot, so called from the black spot on the centre of each wing-case. Another variety has four red patches on the wing-cases, one on the shoulder, and one in the centre of each, on a black ground. The spot may vary in shape; sometimes it is circular, sometimes almost square. In one

Photo: John J. Ward, F.E.S.

Larva of Lady-bird Beetle feeding on aphides on a rose-bud, with an unsuspecting victim walking over its back. (× 4.)

A ramble through the sun-lit beech groves of the "Queen's Bower" cannot but leave in the mind a lasting memory of things sweet and fresh and green.

8.—SOME NEW FOREST TREES

By C. W. COLTHRUP, Z.P.C.

With photographs by the Author

THE New Forest is the last tract of primeval woodland, of any appreciable acreage, remaining from the immense forest that once stretched from east to west of southern England. So far as is known it has never been cultivated; man has felled and planted trees and run his pigs and ponies through its luxuriant glades, but otherwise its inhabitants, animal and vegetable, have lived and grown and died in their own wild way.

In early historic days it was known as a hunting ground of the West Saxon kings, and afforestation was begun by the first of the Normans. From his day to ours it has remained Crown property, regarded of old as a royal hunting ground, but in these days administered more or less as a national park.

Yet the word "park," with its associations of cultivated trees and iron railings, scarcely does justice to the New Forest. For here is England in all her primitive wildness: mighty trees—oak, beech, birch and pine—growing as they will amidst a tangle of self-sown undergrowth, and birds, beasts and insects living in almost undisturbed seclusion. Some of the oaks and

beeches attain an immense girth; the former has been recorded as reaching 24 feet 9 inches, and the latter 21 feet.

One of the outstanding features is the wealth and luxuriance of the many kinds of beautiful lichens, of varying colours, with which the boles of the oak, and in a lesser degree the beech, are covered and not to be surpassed anywhere. Here insects of various orders find a hiding-place, and some a rich feeding ground. Among the smaller trees may be mentioned the alder by the side of streams, holly which grows in large clumps, the wild crab which in spring is a mass of crimson, the spindle tree and the whitebeam.

The "Lady of the Woods." The feet of the birches are often crowded with undergrowth. Two years after the photograph was taken the ground was covered with scrub.

One of the finest views of oak and beech in mass can be obtained from the edge of Fritham Plain looking in the direction of Southampton, and the best time to see it is in the autumn.

To the entomologist, bird-hunter or botanist, therefore, the New Forest is a Mecca where each can find in abundance his particular object of study. And to the lover of wild nature it is a haunt of happiness where he may know peace, solitude and beauty. Wandering down the green glades, where bracken floods the feet of fir and oak and the grey stems of beeches lift their canopy of fresh clear green, one feels instinctively that here is a land that since the world began has remained untouched by the noisy influences of civilization.

Yet man has taken his toll from it. In old days oaks were of paramount importance, many were planted and many felled to provide the wooden hulls of battleships, and wood was also used to feed the iron furnaces of Sussex and Hampshire. The groves of firs are of more recent planting, and the silver-birches that here and there catch the eye with their gleaming stems have probably sprung up of themselves.

To the photographer seeking for studies these birches are not easy subjects, so often are their feet crowded with undergrowth. Two years after the study here shown was made, the ground was again deep in a tangle of scrub, and only the upper boughs of the trees could be clearly seen.

For making studies with the camera a still morning in early spring is the best time, for then can be observed the graceful poise of the trunk, the subtle curves and hang of branches and the delicate tracery of budding twigs. In spring, too, the colour of the forest is delicate and varied. Instead of the monotone of summer green, the woodland shows a purplish haze of crossing stems lightened by the shimmer of buds and crested with the snowy blackthorn that gives its name to the "blackthorn winter."

The fir glades have a character all their own. Here the sombre roofing, the straight, pillar-like stems and the soft carpet of needles that silences one's footfall, all create a solemnity and an almost religious

A group of Silver Birches that have probably sprung up of themselves amidst the close-set undergrowth.

Young Oak trees are everywhere replacing the veterans that were felled in other days when English oak was so much used for the hulls of battleships.

SUNLIGHT THROUGH THE FIRS.

The groves of Firs and Pines are of recent planting, and show an orderliness unknown in the wider, self-sown parts of the forest.

A FOREST GIANT.

The Beeches, left to grow as they will, in many places attain a mighty girth before succumbing to natural decay and the ravages of enemies.

sense of quietude broken only by the soughing of the breeze, or the occasional sharp call of a jay. Here is it that the kestrel, the sparrow-hawk and the long-eared owl love to build their nests, and among the tree-tops many old habitations may still be seen. In the evening, as one passes beneath the trees with noiseless footfall, the silence will be broken by the long, weird hoot of the owl, or sometimes a startled wood-pigeon flutters up and noisily betrays its sleeping place. The lichen that grows over the pale mauve trunks renders them unsubstantial and ghostly in the waning light, and as night comes the whole place takes on the semblance of a dream.

By the stream again all is life and movement. The water splashes and talks as it circles round the bend, and the undergrowth is alive with chattering birds. Here, too, multitudes of caterpillars and insects live and breed, and their surplus numbers provide food for the increasing families of the songsters. Here the solitary pines have room to spread; they are large in girth and grow to a great height. Many parts of the forest go by ancient and picturesque names, one of the most charming being that of the "Queen's Bower." In this beautiful place a ramble through the sun and shadow of the glades cannot but leave in the mind a lasting memory of things sweet and fresh and green.

Perhaps, however, lovely though it be throughout the year, the beauty of the forest reaches its culminating point in late autumn. A night of frost may be succeeded by a still, misty morning, yielding presently to a day of gorgeous sunshine that paints the changing colours of the trees with a brilliancy unknown at any other season. To walk beneath a beech is like walking in a sunset—so glowing is the air. The scarlet of berry, the bronze of the oak, the yellow of maple, birch, and dying bracken with the purple-brown of the heather complete the whole prismatic range.

By the stream all is life and movement. The undergrowth is alive with chattering birds, and here multitudes of caterpillars and insects live, their surplus numbers providing food for the families of songsters.